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Cover Photograph

Come, gentle Spring .. .. .. *J. H. Cookson*

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CLOSE FOLDING OF DAIRY CATTLE WITH THE ELECTRIC FENCE

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WHEN electric fences were first used on a commercial scale they were widely advocated as economical field boundary fences or division fences mounted on new or existing wooden posts. Despite their limitations, electric fences are still being used for these purposes, especially where a permanent fence is not required. In more recent years, however, it is as a very temporary fence or as a fence for folding that the electrified wire has been demonstrating its great value, particularly for use with dairy cattle and pigs. It is a fortunate coincidence that the development of the electric fence for livestock has taken place at about the same time as the widespread introduction of ley farming, for there can be no doubt that the full benefit of leys on the dairy farm will never be reaped until close control of grazing is achieved.

The use of the electric fence for folding gives scope for a good deal of planning, both as regards crop lay-out and fencing equipment. In both, a little ingenuity can save much labour and inconvenience. In the equipment there is, indeed, a happy hunting ground for the "gadgeteer," but it is hoped that he will always keep in mind the need for saving labour under field conditions.

The daily folding of cattle on leys has several advantages. Soiling of the uneaten sward by dung and urine is reduced to a minimum ; selective grazing of the palatable species, and consequent undue encouragement of the unpalatable species, is greatly decreased treading, dung, and urine are spread more evenly over the field. Day-to-day grass consumption can be controlled and kept at a fairly constant level, thus avoiding the sequence of overfeeding and underfeeding which is a normal attribute of summer grazing on a field basis. Similar arguments can be put forward in favour of daily folding of kale in winter. Here the prevention of selective grazing applies to the leaves as opposed to the the stems. In grazing kale by the field or by large folds lasting several days, there is usually a marked tendency for animals to eat the leaves first and the stems later. Since the dry matter of the leaves contains about three times as much protein as the dry matter of the stems, there is a big day-to-day variation in protein consumption.

There is, however, little practical significance in these advantages if they are offset by the cost of the equipment or the labour involved in daily folding. At the National Institute for Research in Dairying we have been interested in this problem for two or three years, and our experience suggests that with careful planning the cost of equipment and labour involved in daily folding can be reduced to very modest dimensions.

CLOSE FOLDING OF DAIRY CATTLE WITH THE ELECTRIC FENCE

Equipment for Close Folding Apart from the usual requirements for efficiency, such as correct height, good insulation from earthing, reliable batteries, etc., an electric fence used for daily or frequent folding should also be rigid and capable of being moved easily. Rigidity is particularly important where a plain wire is used; the cattle may frequently reach for the uneaten crop under the fence, which, if loose, may ride up over the long hair at the top of the neck without imparting a shock until the wire comes in contact with the withers; then the cow may jump forward into the crop. Where barbed wire is used, the barbs help to impart the shock through the hair. Similarly, a *taut* plain wire pressing through the hair on the neck will impart the shock.

The fence, including wire, posts, unit, and all accessories, should be easily portable. The weight should be low, so that one man can carry on his back the complete outfit for the fold: say 150 yards of wire, fencer unit, posts, and end attachment gear. If the fold is to be moved daily the dismantling and re-erection of the fence should be so simple that one stockman can easily do the job with the minimum of tools—better still, with no tools at all. Equipment should be such that, given reasonably soft ground and a planned moving routine, 150 yards of fencing can be moved from one position to the next by one man in, say, 15 to 20 minutes. The ends of the folding wire must be easily attachable to the side fences.

We have found that these requirements may best be met by using metal rod posts fitted with the shed-type pot insulators, and tripod anchors fitted with a reel for straining at one or both ends of the wire. The straining anchors are, of course, insulated from the electrified wire.

METAL ROD POST Various types of metal rod post have been tried (Fig. 3, p. iii art inset), but they may be grouped according to their method of ground attachment. Thus there are posts with single straight points, with two or more straight points, with corkscrew points, and with the base let into a concrete foot to stand on the ground. With the latter method, which has been used on the Continent(1), the base of the post is embedded in the centre of a concrete block about 10 inches square and 2½ inches deep; this type may be useful on very hard ground, but it appears too heavy for general use. Corkscrew posts may be especially useful where there are depressions in the run of the fence. The choice for general use seems to lie between the post with a single straight point and one with two points. In our experience, the latter appear to be more useful in soft ground, where they can be erected easily by foot pressure. In hard ground the single point is the more suitable, since it can be "pitched" in the same way as a hole is made with an iron bar. For this reason there is much to be said in favour of a weighted single-point post, with the weight welded on near the point to facilitate "pitching" but far enough from the point to allow penetration into the ground. The weight should also be shaped so that it can, in soft ground, be used as a step for foot pressure. A rod post similar to that shown second from the right in Fig. 3 appears to meet most of the requirements for general use in a folding scheme.

INSULATOR The shed-type insulator may be fitted to the top of the post or to a bracket, which can be fixed to the post at any height from the ground (Fig. 4). The former method is less expensive and is satisfactory if the height of the post is correct for the class of stock concerned. For dairy cows the ideal height from the ground to the top of the insulator appears to be about 2 feet 6 inches. Thus, allowing 8 inches for the point, the overall length of the post would be about 3 feet 2 inches.

STRAINING ANCHOR A straining anchor performs two functions: it acts as a rigid point of attachment at the end of the folding wire, and it mounts the wire-straining device. The latter can be a lever or a reel with a handle and some form of spring- or gravity-loaded holding pawl so that when the wire is strained by turning the reel it remains taut until released by raising the pawl (Fig. 5). A similar reel with a small diameter drum will exert, with hand pressure, enough strain on the wire either to break it or move the anchor. If a tripod anchor with a corkscrew rear leg to give good ground attachment is used (Fig. 6), a tensile load in the wire of 150-200 lb. can be obtained. This will often break old 14- or 16-gauge galvanized single ply wire, but a wire of this gauge in fairly good condition should not break at, say, 80 or 100 lb. strain, which will give a good taut fence without much sag, even if the posts are 20 yards apart. It is important, however, to avoid using "kinked" wire. Last summer, using straining anchors and a single plain electric wire, we fenced a herd on a rather sparse ley against growing corn on a quarter-mile front with posts at least 30 yards apart. Besides its use for folding, a straining anchor is also useful in place of a corner post in a fixed position (Fig. 7).

The total weight of one folding outfit which we use for a 200-yards run is 102 lb. 12 oz., made up as follows:

	lb.	*oz.*
2 tripod anchors and straining reels	22	4
10 metal rod posts with insulators	28	12
200 yards wire	10	—
Fencer unit on vertical screw post, complete with dry battery and handle	41	12

The amount of equipment actually moved each day can, however, be reduced to about 60 lb. for a 200-yards fold by attaching the unit to an independent wire on insulators along one side of the field so that the folding wire can be connected up at any point along the side of the field, care being taken that the anchor is insulated from the side wire, from the folding wire, and from the connection between the two.

Folding Leys The daily, twice-weekly, or weekly folding of leys by dairy cows does not counterbalance lack of planning of the grazing leys, and, in fact, it may not be too much to say that folding is not worth while unless it is integrated with a policy of sowing and manuring leys to secure a good sequence of grazing throughout the season. Folding is also complementary to grass silage-making, the grazing being restricted to the amount which the herd requires and the surplus being ensiled while at its maximum nutritive value. In the interests of convenience and labour saving, attention must also be given to the arrangement of the fields; accessibility, water supply, shade, and shelter are obvious points to be considered. It is an advantage to fold across a field with approximately parallel sides, to avoid the inconvenience of changing the length of the folding wire from day to day. This requirement can sometimes be met by using an electrified wire to form a false side fence parallel to the opposite side fence, the grass between the first natural side fence and the false one being grazed separately. This method also gives a live wire for connection to the folding wire as it is moved forward.

The question of fertility transference needs some consideration. If the folding is repeated on the same field several times and the cows are allowed continually to run back to the back fold, there will be a transference of nitrogen, phosphate, and potash from the last folds to the first, particularly if the gate and water are in the first fold. One answer to this problem would be to start the second grazing of the field from the other end, but usually

access and water would not be available at the other end. There is also another problem to be considered if the folding of a particular ley is likely to last longer than a few days : this is the grazing that is likely to take place in the run-back, as the grass grows there while the folding is progressing in the later half of the field. Grazing in the run-back should not be encouraged, partly because the output will be lowered if grazing takes place too soon after the folding, and partly because the grazing will be selective and will tend to encourage coarse grasses and weeds at the expense of desirable grasses and clovers.

Both these problems are solved by using a second wire as a back fence and moving it towards the forward-folding fence, say, once a week or once a fortnight. If the back electric fence cuts off water and access, the difficulty can be overcome in several ways. A service corridor connecting the gate and water with the fold is one solution ; this can be formed by the permanent fence on one side and an extension of the back-folding fence on the other (Text Diagram 1). Another remedy is the "half clock" system, where the gate and the water are at about the middle point along one side of the ley. In this system a service paddock is formed around the gate and water, from which the two folding wires radiate to the other sides of the field like the hands of a clock, with the service paddock acting as a pivot ; the forward wire moves daily like the minute hand, and the back wire weekly or fortnightly like the hour hand (Text Diagram 2). One disadvantage of this system is the variation in length of wire from move to move.

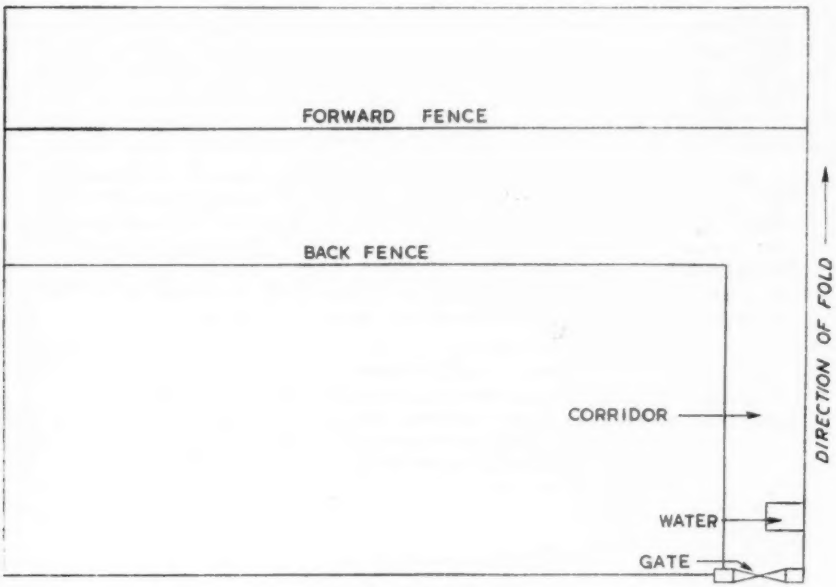
Either of these methods, or any other in which a service paddock or corridor is provided, protects the back-run but may well spoil the sward on the paddock. Against this, however, in addition to water and access, it could be used to site a mineral supply and might also provide shelter and shade.

Folding Kale The folding of kale has previously been discussed by John (3), Hosier (5), and Stubbs (4). Like them, we have found this a labour-saving method, and with the new equipment daily folding is quite feasible. Under our conditions, however, we aim at using kale as a cleaning crop and, apart from inter-row cultivation, attempt to grow a heavy crop by fairly liberal manuring, which partly smothers out weeds as the crop grows. This creates a problem in folding, since the kale, particularly marrowstem, grows much higher than the wire and causes earthing. It is, of course, possible to lop the tops of one row to form a track for the wire, but if, as is recommended, a 2½- to 3-yards run of folding wire is allowed for each cow, a run of 125–150 yards will need to be lopped each day for a herd of 50 cows, and this extra work makes kale folding much less attractive. The crowding caused by reducing the length of fold wire below 2 yards per cow is illustrated in Fig. 1 (p. ii art inset). Where nearly 3 yards' run per cow was allowed, little damage to the crop resulted, and it can be seen from Fig. 2 that there was no crowding. A possible solution to the problem is to *grow* a track for the wire by sowing in one row of the drill a plant which will not grow to the height of the wire.

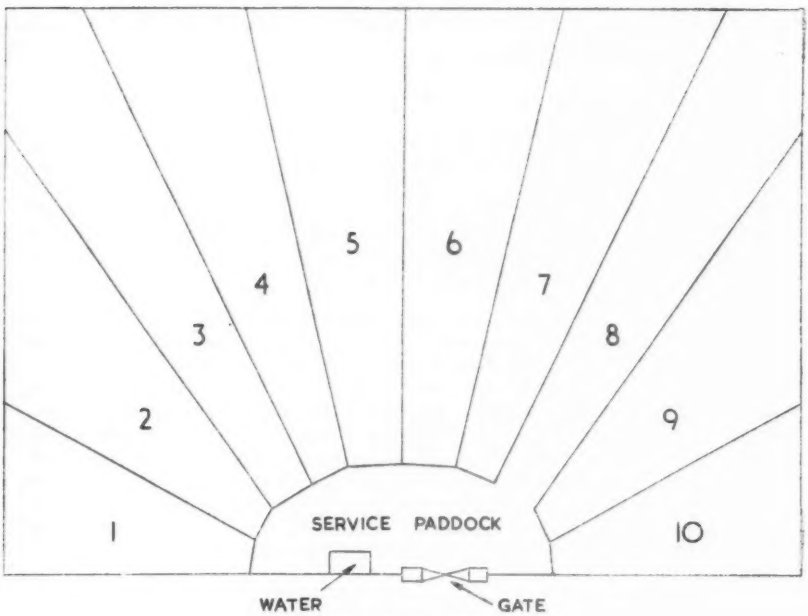
In 1947 we used Hungry Gap kale in place of marrowstem in every fourth row ; the dry summer and early sowing of the Hungry Gap, however, provided little food in December when the crop was folded.

In 1948 we tried sowing cabbage in every fourth row. The cabbage seed was diluted with three times its weight of dead brassica seed before sowing in order to produce a thin stand of cabbage in the row without altering the drill mechanism or committing ourselves to hand singling. Apart from the formation of a track for the fencing wire, we hoped to get a modest cabbage crop, and varieties suitable for human consumption were used. Thus in the

CLOSE FOLDING OF DAIRY CATTLE WITH THE ELECTRIC FENCE



Text Diagram 1.



Text Diagram 2.

marrowstem kale for late November and early December folding we used Christmas Drumhead, and in the thousandhead kale for later folding every fourth row was sown with January King. Once again we were not entirely successful, partly because the very good growth of the kale tended to shade the cabbage, thus preventing satisfactory hearting and making it still necessary to trim back some of the kale when erecting the fence each day.

It seems probable, however, that cabbage might meet the requirement for early winter if two rows side by side were used to form the track for the fence. This would, of course, reduce the yield of kale per acre considerably, but if a heavy yielding cattle cabbage were used the total nutrients need not be much less. For later folding a low-growing thousandhead or Hungry Gap, or a hardy variety of cabbage, might replace one or two rows in the drill when sowing the normal thousandhead break for folding.

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THE CONTROL OF HOARY PEPPERWORT

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THE farmer, by tradition, is not in the habit of counting his blessings aloud, and when they are blessings in disguise they may well be overlooked. It is, for instance, singularly fortunate that, although many foreign plants have been introduced into England by intent or accident during the centuries, there has been no problem of a foreign weed menace comparable to that in many other countries, such as the bramble or ragwort in New Zealand or the prickly pear in Australia.

One might even go so far as to say that there is no problem at all were it not for the foreign introduction of hoary pepperwort (*Cardaria* (*Lepidium*) *draba*), a member of the cabbage family. This weed has many local aliases, e.g., Devil's cabbage, chalkweed, whitlow pepperwort ; another one, Thanet weed, betrays the point of entry into this country, for it was in this area of Kent that it was first noted in 1809. In the latter half of the nineteenth century pepperwort was still something of a rarity, though it had been recorded in Kent, Essex, Surrey, Cambridgeshire, and as far afield as Glamorgan, Cheshire and Worcestershire. Today over considerable areas of heavy clay, particularly in the south-east of England, this species is perhaps one of the worst weeds that farmers have to contend with in their winter wheat and bean land.

Eradication by the ordinary methods of cultivation has been both tedious and expensive. It involves the substitution of spring- for autumn-sown crops, and it is often difficult to prepare good seedbeds at the proper

time in the spring on the heavy clay soils where the weed is generally found ; moreover, even if crops are sown in the spring, there is no guarantee that the weed will be eradicated without the introduction of bare fallows, which entail a complete loss of crop. The alternative of developing a selective herbicide capable of destroying such a perennial weed seemed out of the question until 1945. By then it was known from the previous two years' investigations* that the growth-regulating substances MCPA (2 methyl-4-chloro-phenoxyacetic acid) and DCPA (2 : 4-dichloro-phenoxyacetic acid) were capable of killing some perennial plants and were highly toxic to many species of the cabbage family. It was, therefore, not unreasonable to suppose that hoary pepperwort might be susceptible to these compounds, and the preliminary trials carried out in 1945 proved this to be so.

Investigation of Three Main Problems In 1946 we planned full-scale experiments in Essex. It seemed too much to expect that complete eradication could be achieved in a single season. Arrangements were therefore made to carry on the trials for at least two, and possibly three, years with a cropping programme of two successive winter cereal crops followed, if necessary, by a third spring-sown crop which was also known to be resistant to the growth-regulating substances—for example, linseed.

Again, on the basis of the earlier work, it was clear that several factors needed investigation. First, what is the most effective concentration ? Secondly, is the degree of kill dependent upon the stage of growth at the time of spraying ? Thirdly, can a greater kill be achieved by spraying more than once in the season—say, in the spring and again after harvest when the plants regenerate ? It was decided to combine all these factors in single experiments, and this meant that in the largest trial there were 120 plots.

Before considering the results it is important to know how they were arrived at in the several experiments. Before spraying the plots for the first time, the density of hoary pepperwort shoots on each plot was determined by counting a number of random sample areas, and in the following spring all the plots were re-counted to assess the degree of kill before being sprayed for the second time. The same procedure was repeated a year later, and, in determining the percentage kill, allowance has been made for the change in density on the control plots from season to season. Although the results from individual experiments are extremely complex, because of the experimental design, they can as a first consideration be broken down to provide answers to the three main questions.

Concentration of Spray Solution Examining the effect of varying concentration in the spray solution, when it was applied at the standard rate of 100 gallons per acre, there is an extremely good agreement both between experiments and season for the effects of spraying on the number of shoots emerging a year later. From the data set out in Table 1 for three trials there is no doubt that increasing the concentration of the growth-regulating substance from 0.1 to 0.2 per cent has led to a greater kill, while a further rise in concentration to 0.4 per cent produces on average no appreciable gain in effectiveness.

* The present and previous investigations have been supported by grants from the Agricultural Research Council.

Table 1

Effects of Varying the Concentration of the Chlorinated Phenoxyacetic Acids on the Control of Hoary Pepperwort

Concentration of Spray Solution *per cent*	Percentage Kill Experiment I 1946–47	Experiment II 1946–47	Experiment III 1947–48
0.1	71.4	59.4	62.5
	*		*
0.2	79.4	64.1	77.2
	*		*
0.4	80.0	66.1	85.7

An asterisk denotes that the difference between the adjacent figures is significant (P=0.05) when the transformed data are analysed statistically.

Optimum Time of Application

Whereas the results for the concentration effect are clear cut, the relationship between susceptibility and stage of growth are far more complex. Considering first the experiments in which the plants are sprayed (i) when the plants are just emerging through the ground and are 1–2 inches high, (ii) when the plants are 12–14 inches high and beginning to flower, and (iii) when the plants are sprayed after emergence and again at the flowering stage, then not only is the time of application important, but also the chemical nature of the compound. From the results given in Table 2 it is evident that spraying at the flowering stage is better than spraying early and more than the equal of spraying at both stages, but a comparison of the results for MCPA and DCPA is not so straightforward. On the basis of either the single spraying at flowering or the double spraying, there is nothing to choose between the two compounds, although with the early spray the plants are far more susceptible to MCPA.

Table 2

Inter-relationship between the Time of Spray Application and the Relative Toxicity of MCPA and DCPA

Stage of Growth at Time of Spraying	Percentage Kill MCPA (sodium salt)		DCPA (acid)
Emerging Shoots	74.9	*	58.9
	*		*
Flowering Shoots	84.7		85.9
	*		*
Sprayed at both stages	79.1		75.8

* Differences significant.

Double Spraying in One Season

Considered by itself, the evidence given in Table 2 for the interdependence of relative toxicity and stage of growth might be regarded as an experimental fluke, but the results of other experiments are equally consistent. This consistency is illustrated by the figures set out in Table 3 for a complicated experiment where the pepperwort was sprayed (i) when the flower-buds could be clearly seen, (ii) when the plants were in full flower, and (iii) when regeneration of shoots had taken place in the autumn stubble. In addition to this set of comparisons for the effects of a single spraying, there were three double sprayings, namely, (i) pre-flowering and flowering, (ii) pre-flowering and autumn regeneration, and (iii) flowering and autumn regeneration.

Table 3

Inter-relationship between the Time of Spray Application and the Relative Toxicity of MCPA and DCPA

Stage of Growth at Time of Spraying	Percentage Kill		
	MCPA (sodium salt)		DCPA (acid)
Single Sprayings			
Pre-flowering	77.0	*	46.9
Flowering	58.2	*	69.4
Regeneration	42.2	*	11.8
Double Sprayings			
Pre-flowering and flowering	73.7		69.8
Pre-flowering and regeneration	83.6	*	66.8
Flowering and regeneration	75.1		* 80.3

* Differences significant.

It is clear that if the plants are given a single spraying either in the pre-flowering or regeneration phases, MCPA is superior to DCPA, whereas there is a strong indication that the reverse is true when plants in full flower are similarly treated. The effects of double spraying within the season are even more confusing : the two substances are of equal merit when spraying takes place at pre-flowering and flowering stages, or flowering and regeneration stages, but of unequal merit for the other double spraying treatment.

Although these results seem at first sight to be haphazard, precise conclusions can be drawn. It is evident that the most successful kills have been achieved with MCPA in the pre-flowering stage and with DCPA in the flowering stage. It is also apparent that double spraying has not led to marked increase in the degree of control.

Spraying in Two Successive Years

So far consideration has been given only to assessing the results of spraying within a single season, and even when the pepperwort is treated under the optimum conditions as affected by stage of growth, compound, and concentration, eradication is by no means complete. The next step is to examine the results obtained in the third year, after the plants have been sprayed in two successive years. Although at first sight the array of figures in Tables 4 and 5 appears formidable, the conclusions that can be reached are fairly clear.

Table 4

Effects of Concentration, Time of Application and Compound on the Gain in the Degree of Control obtained by Spraying in Successive Years

Stage of Growth at Time of Spraying	Percentage Kill			
	MCPA (sodium salt)		DCPA (acid)	
	Sprayed 1946	Sprayed 1946 and 1947	Sprayed 1946	Sprayed 1946 and 1947
Emerging				
0.1 per cent concentration	63.6	95.4	53.7	96.2
0.2 per cent concentration	73.6	98.2	70.9	95.4
Flowering				
0.1 per cent concentration	78.6	89.5	83.2	93.4
0.2 per cent concentration	86.7	98.3	86.6	95.9
Spraying at Both Stages				
0.1 per cent concentration	70.8	97.1	77.2	97.5
0.2 per cent concentration	81.4	98.7	75.1	97.2

It is seen from Table 4 that at concentrations of 0.1–0.2 per cent, spraying in two successive seasons has given a higher percentage kill than a single spraying. It is equally evident that with the double spraying the influence of the type of compound or the stage of growth is of considerably less importance, for the range of kill varies only from approximately 90 to 99 per cent, as against approximately 54 to 87 per cent after one season's spraying. Likewise, there is no advantage in spraying twice in a season.

The same trend for the differences between treatments to be diminished at the end of two years' spraying is shown by the results in Table 5. The advantages of spraying twice at yearly intervals as against treatment for a single year are, however, far less pronounced than in Table 4. In fact, the autumn application at the time of regeneration resulted in little or no gain in effectiveness.

For the pre-flowering stage of development two yearly sprayings with MCPA give the highest kill. The degree of control is reduced from 84.5 to 74.4 per cent if spraying is delayed until the full flowering stage has been reached. Such a delay, however, improves the performance of DCPA, but the kill attained does not reach the level of MCPA at the pre-flowering stage.

Turning to the results for a double spray within the same season, there is some indication that MCPA is superior to DCPA. In contrast to Table 4 there is something to be said for spraying twice in the spring for two years running, but the two extra applications have produced only a relatively small return.

Table 5

Effects of Time of Application and Compound on the Gain in the Degree of Control obtained by Spraying in Successive Years

Stage of Growth at Time of Spraying	Percentage Kill			
	MCPA (sodium salt)		DCPA (acid)	
	Sprayed 1946	Sprayed 1946 and 1947	Sprayed 1946	Sprayed 1946 and 1947
Single Spraying				
Pre-flowering	77.0 *	84.5 *	46.9 *	64.1 *
Flowering	58.2 *	74.4 *	69.4 *	73.6 *
Regeneration	42.2	40.0	11.8	22.5
Double Spraying				
Pre-flowering and Flowering	73.7	93.1	69.8	85.8
Pre-flowering and Regeneration	83.6	88.0 *	66.8 *	79.4
Flowering and Regeneration	75.1	80.5	80.3	78.2

* Differences significant.

Effectiveness of Ethyl Ester of DCPA

Before attempting to summarize these experiments, there is one further set of results which is worthy of consideration, namely, a comparison of the sodium salt of MCPA with the ethyl ester of DCPA made up in oil and applied as an emulsion in water. Once more the comparison was made either at the pre-flowering stage or when the plants were in flower. From Table 6 it is seen that at the pre-flowering stage there is no compound effect, but at the time of flowering the ester of DCPA is greatly superior. This interaction between stage of development and the relative toxicity of the two substances is far more striking than those seen in the previous tables,

but the explanation lies not so much in the differing susceptibility of the plant to the two compounds as in the effect of climatic conditions on the persistence and penetration of the salt and the ester. At the time of the first spraying the weather remained fine, but within an hour of the second spraying rain fell heavily, causing a greater loss of MCPA because it lacked the "rain-proofing" action of the oil in the DCPA emulsion.

Table 6

Effects of Compound and Stage of Growth on the Control of Hoary Pepperwort

Stage of Growth	Percentage Kill after Single Spraying		
	MCPA (sodium salt)		DCPA (ethyl ester-oil emulsion)
Pre-flowering (fine weather)	90.1		92.7
Flowering (wet weather)	23.5	*	84.8

* Differences significant.

Conclusions It may be thought that the results of this investigation have been set out in too much detail, but on occasion it is worth while illustrating that the development of a new technique in selective weed control is not just a matter of sudden inspiration, but a tedious unravelling of a complex situation. Besides, this investigation has revealed a new factor which must be taken into account in assessing the relative potency of the growth-regulating herbicides for the control of perennial weeds. It is now apparent that statements about the differences between allied compounds can be precise only if comparisons have been made at various stages of the growth cycle. If this factor is not considered, wholly conflicting claims may be put forward. Because of this complexity a simple recommendation with no provisos cannot be given for controlling hoary pepperwort.

First, it is clear that the cropping system must be planned so that on infested fields two autumn-sown cereals are grown in successive years, followed in the third year by perhaps a spring-sown crop which will also be resistant to either MCPA or DCPA. Secondly, *if MCPA is used* the hoary pepperwort should be sprayed in the spring at the time when the *flower-buds are forming*, at a concentration equivalent to 2 lb. in 100 gallons per acre, whereas *with DCPA* spraying at 0.2 per cent should not take place until the pepperwort is *in flower*. Thirdly, it is not sufficient to spray for one season only; it is necessary to spray in two consecutive years. As the figures in Table 4 show, two successive yearly sprayings can give almost complete eradication. However, complete kill after two years' treatment is not invariably the rule and, as an insurance, provision should be made for the spring sowing of a third crop which is resistant to the growth-regulating herbicides. Then if any surviving pepperwort plants appear they can be sprayed. In view of the likelihood that the crop will be well advanced in growth before the pepperwort is fit to spray, it will be better to use MCPA and this is essential if the spring crop is linseed.

These recommendations, which involve a spraying programme over three years, may appear formidable, but those who suffer from infested fields know that pepperwort is a most formidable weed.

HIGH QUALITY DRIED GRASS

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National Agricultural Advisory Service, Cambridge

SINCE the original suggestion by Dr. H. E. Woodman at Cambridge that young grass of high protein content could be conserved by artificial drying for winter feeding of livestock, commercial grass drying has developed slowly but steadily into an important small industry in this country. The present national necessity for increased supplies of feedingstuffs, particularly protein foods, has given a strong impulse towards making the maximum use of one of our most important crops—grass; and there is little doubt that dried grass of high nutritive value will play an ever-increasing part in the winter feeding programme for dairy stock. Nevertheless, there are critics of the scheme who argue that the use of fuel, another relatively scarce commodity, is hardly justified to dry much of the material now being put into grass driers, and published figures of the composition and nutritive value of some of the samples of dried grass produced of late certainly add weight to their argument ; there is little doubt that the actual nutritive value of some dried grass is much lower than it should be.

Value of the Finished Product Manufacturers of grass driers have spent much time, money and effort in designing machines of high thermal efficiency, and a great deal of attention has been paid to machinery for coping with the grass crop in the field and in getting it to the drier. Despite these improved mechanical services, it must be remembered that the actual value of the final dried product is still greatly dependent upon the skill and judgment of those responsible for the more purely agricultural side of grass drying, and that no method of conservation can do more than conserve the maximum amount of nutrients actually present in the grass crop at the time of cutting. Subsequent mishandling of the crop can waste or destroy a proportion of these nutrients, but the ultimate value of the finished dried product cannot exceed that of the crop at the time it is cut for drying.

From figures already published, and from the reports of Provincial Nutrition Chemists in the National Agricultural Advisory Service on samples of dried grass received for advice on feeding value, there is little doubt that the average quality of dried grass produced in this country is not as high as it should be, and it appears that in too many cases quality is being sacrificed for quantity. There may be many reasons for this, but one of the principal factors in the past has been the basis of the selling price for dried grass—namely, carotene. This is an important, but nevertheless minor, constituent of the final product, and there has been an unfortunate tendency to regard carotene content as the be-all and end-all of dried grass, to the exclusion of the major food constituents on which the actual feeding value depends. The crucial test of a feedingstuff is the number of food units contained per unit weight, for on these depends the productivity in terms of milk, growth, liveweight increase, fattening or egg production that constitutes the ruling factor in the economics of livestock husbandry. The nutritive value of dried grass is proportional to the *crude protein* content, and the assessment of quality by determining the crude protein present would seem more logical than attempting to assess it on a rather unstable constituent such as carotene, which is very unlikely to exceed 0.04 per cent.

Since the nutritive value of dried grass is closely related to its crude protein content, we may approximate the well-known regression equations

given by Professor S. J. Watson for the starch equivalent (S.E.) and the protein equivalent (P.E.) as follows:

$$S.E. = 38 + 0.9x \qquad P.E. = x - 5.5$$

where x = the crude protein content of the dry matter.

Assuming the typical S.E. : P.E. ratio of 5 for milk production, we find that when x=16 per cent the grass is balanced for this purpose; for maintenance purposes a ratio of 10 gives x=10.2 per cent.

Dried grass always picks up a certain amount of water to come into equilibrium with atmospheric moisture, and it was thus felt that to calculate the crude protein content, not to the dry matter basis but to the 90 *per cent dry matter basis* (10 per cent moisture), afforded a more practical guide to the actual amounts of dried grass to be used for milk production purposes. Accordingly, a scheme of classification of dried grass samples on the crude protein content, referred to the 90 per cent dry matter basis, has been drawn up by the Provincial Nutrition Chemists of the N.A.A.S., and the following categories of evaluation, with indications for feeding, have been suggested.

Category	Crude Protein (90 per cent dry matter basis) *per cent*	Amounts of Dried Grass to be Fed for the Production of One Gallon of Average Milk
A	17 or over	5 lb.
B	15 to 16.9	5½ lb.
C	13 to 14.9	Either (a) 5 lb. dried grass *plus* ½ lb. of high protein cake *or* (b) 4 lb. dried grass *plus* 1 lb. medium protein cake or beans.
D	11 to 12.9	Either (a) 4 lb. dried grass *plus* 1 lb. high protein cake *or* (b) 3½ lb. dried grass *plus* 1½ lb. medium protein cake or beans.
Ungraded	Less than 11	Suitable for maintenance purposes only.

Dried Grass Production in Practice To justify, from the economic angle, a grass drier on a farm or a co-operative group of farms, the plant must be in operation fairly continuously throughout the grass-growing season, and this necessarily implies a fairly constant supply of fresh grass. If the growing season were such as to permit of a mathematically constant rate of growth of grass throughout, the supply problem would be simple, as a specific acreage could be set aside for cutting to ensure a constant supply equal to the capacity of the drier. The growth of grass is, however, very variable; the spring flush and the smaller late summer growth provide peak periods of productivity, and the summer production is very largely at the mercy of the weather. High protein quality grass can be produced only when the crop is relatively immature, i.e., before the onset of flowering and seed production, and this again is a factor depending on the species of the grasses and the season. It follows, therefore, that since the growth rate of grass is variable throughout the six months drying season, to dry all the produce of a particular acreage either the quality must fall off seriously at certain times or the plant must remain comparatively idle for considerable periods throughout the season. On economic grounds alone there must necessarily be periods when there is more grass available than can be dealt with by the drier to allow for full production at the periods of slowest growth, and hence some other means of disposal of surplus must be provided for.

It is in such instances that ensilage and haymaking must play their part complementary to the main drying venture. This raises serious labour difficulties on many farms, but it is most essential to be able to deal with the surplus by cutting and removal in order to allow the new, young and most valuable grass to come on again ready for the drier. Otherwise a vicious cycle is established, and the quality of the material actually being dried seriously deteriorates until the last fields in a series of consecutive cuts are in too mature a stage of growth (to be dried) to give a high protein quality material. If a crop has reached the hay stage of growth, haymaking is the only logical method of dealing with it. With a grass drying concern, the system of management should provide for drying grass in the relatively young state, silage-making when the crop is maturing, and haymaking when the crop has reached the almost mature stage. This places a great responsibility on the manager of a drying plant, but it is essential that he should be fully aware of the changes in protein quality of the grass crop as it approaches maturity, and it should be his aim to arrange for alternative methods of conservation when the conditions of his various grass crops warrant.

Practical Results with a Mixed Conservation Policy

This year we have carried out a series of analyses of samples of dried grass taken daily from a large farming concern in the Eastern Province which was attempting to produce a high quality article for winter feeding of dairy stock. At the beginning of the season it was arranged to treat the drying problem virtually as a factory process with a close analytical control of the products; as soon as the quality of a particular field began to deteriorate, a message was sent to the manager, the remainder of the crop was made into silage or left for hay, and another field of younger material was started. Where three or four fields were ready for the drier at about the same time, random samples of the fresh herbage of each were taken and sent in for rapid analysis, and within twenty-four hours the best field was selected. We based our recommendations on the assumption that the crude protein content (90 per cent dry matter basis) would probably fall by 2 per cent over the next week and by 4-5 per cent by the end of a fortnight. The decision as to how much of a particular field or fields should be dried was left to the manager and depended upon the estimated productivity, the acreage, and the rate at which the grass could be dried.

The value of this experimental analytical control of the quality is reflected in the following figures. Sampling was carried out by a competent workman, who withdrew an ounce or two of the milled or baled product at hourly intervals, the whole being thoroughly mixed at the end of the day and sub-sampled for analysis. Since analyses for crude protein and dry matter only were required, it was possible to organize the laboratory side of the work so as to get results with the minimum of delay.

Percentage Distribution of Samples

Category	Percentage
A	38
B	26
C	26
D	8
Ungraded	2

It will be seen that almost two-thirds of the total production of this plant was a concentrate approximately balanced for milk production, and that only 10 per cent of the total fell below the figure of 13 per cent crude protein (90 per cent dry matter basis). The highest value found was 22.9 per cent

protein, the lowest 9 per cent and the overall average for the season was 16.36 per cent (S.D $\pm$2.36).

These figures speak for themselves and are ample testimony to the fact that by an intelligent system of grassland management it is possible to provide a regular supply of high quality grass suitable for drying. In addition to a very valuable supply of dried grass, equivalent in nutritive value to a balanced cake, a very useful tonnage of grass silage has been produced, averaging between 12 and 15 per cent crude protein on the dry matter. So far we have not made a chemical examination of the hay which, like much of that produced in the 1948 season, suffered from the adverse weather at haymaking time. Nevertheless, owing to the paramount need for a continuous supply of high quality grass for the drier, the hay was cut at least a fortnight earlier than is customary in this area and, judging by its general appearance, it is likely to be of much higher feeding value than most of the hays examined in the course of our routine advisory work.

The main purpose of this article is to lay emphasis on the statement that artificial drying of grass, ensilage and haymaking, are essentially complementary processes in the conservation of grass for use in the winter feeding of livestock. Grass drying, because of the high initial costs of the drier and correspondingly high overhead charges, must necessarily be the most costly of these processes, probably about £1 per unit percentage of protein; but it is a process which, when carried out efficiently (i.e., with least loss of the food nutrients of the growing crop), conserves the food units so urgently needed for the livestock expansion programme. It should be the aim of the manager of every grass drying plant to ensure that the highest possible quality raw material reaches the drier, and to maintain this high standard he should be in a position to arrange for supplementary means of conservation such as ensilage and haymaking so that potentially high quality grass is always coming along to be available when required for drying purposes.

It may not be possible, nor is it necessarily desirable, to maintain so close an analytical control over a grass drying process as during the present investigation; nevertheless there is much to be said for analysis of representative samples at least twice weekly when the crop of any particular field is being dried, and more often if a larger number of small fields is being cleared at more frequent intervals. A safe, practical guide to visual control of the drying process is that no grass should be dried after it has reached the flowering stage; at this point the herbage starts to become fibrous and the protein content (and hence the nutritive value) falls to a point at which there is little justification for using valuable fuel for drying. When grass has reached the hay stage the proper course is to make hay of it.

Correction

Ensilage, with Particular Reference to the A.I.V. Process (March, 1949), p. 517, line 2, read "*. . . . is added to the ration.*"

IN PREPARATION FOR GRASS DRYING

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Ministry of Agriculture and Fisheries

NOW is the time to begin getting the grass drying equipment into good order and to plan its upkeep during the busy months ahead. Machinery for grass drying—a process that depends for its success upon a smooth continuity of operations—must be reliable as well as efficient. There must be no interruptions due to mechanical breakdowns. Well-planned maintenance can increase reliability and help efficiency.

There are of course limits in efficiency which no amount of care in the operations can overstep. Thinking of the drying plant itself, we have the fact that even in theory 1 ton of coke evaporates only about 11 tons of water and that 1 ton of fuel oil evaporates only about 17 tons of water. If our drier has a practical efficiency of even 50 per cent of these figures, we are doing fairly well and, since in a season of normal rainfall and growth we have to dry away seven-tenths of the weight of freshly cut grass, we must make up our minds to use nearly 1 ton of coke to produce 1 ton of dried grass. Usually there is still a margin left in which fuel economies can be made. No hot air should be allowed to escape from the drier without collecting its full share of moisture, and any leaks must be repaired. Also, the structure should be well insulated so that loss of heat by radiation is reduced to a minimum. Surfaces which become hot should, wherever possible, be lagged with asbestos.

Choice of Fuel We must use suitable fuel—the best we can get—and see that every bit or drop is burnt to full advantage. Where large quantities are being used, a great deal can be lost even while it is being transferred from container to burner. Coke must be stored neatly and shovelled carefully, and fuel oil tanks and pipes must be kept free from leaks.

Several grades of fuel are available for oil-fired heaters. It is important to use the right grade for the particular plant, and advice on this point should be sought from the suppliers of the fuel. For most driers it pays to use Gas Oil (Diesel Oil), because this grade, which has a viscosity of about 35 seconds Redwood 1 at 100°F., is fluid enough at ordinary air temperatures to form the fine spray of oil particles necessary to make intimate contact with the stream of air for combustion.

Some heavier oils are cheaper and can be burned satisfactorily in driers specially designed to take them. One grade—Medium Fuel Oil—has a viscosity of about 200 seconds Redwood 1 at 100°F. and requires to be preheated to 140°F. before it will atomize properly at the burner. A still cheaper grade—Heavy Fuel Oil—has a viscosity of nearly 1,000 seconds Redwood 1 at 100°F. ; it is necessary to heat the storage tank to make this fuel flow to the burner, and then the oil must be brought to about 220°F. for atomization at the burner. When the heavier fuels are used, maintenance work on cleaning the burner must be done particularly thoroughly and frequently, otherwise there is some risk of incandescent carbon particles passing through with the heated air and firing the crop.

Machine Maintenance in Plant . . . Regular correct lubrication of the moving components of the plant is probably the most important part of maintenance, and it is well to lay in a small stock of suitable oils and greases in good time for the season. A point to remember in choosing the grades of lubricant is that some of the bearings in the drier (e.g., those of the hot air fans) are working at a very high temperature when the plant has been in operation for some

hours, and a grease having a very high melting point must be used in these bearings.

Belts should be fitted on to their pulleys and adjusted. At this first adjustment, and at re-adjustments during the season, they should be put no tighter than is necessary to prevent slip. Belts that are unnecessarily tight cause excessive wear on the bearings of both the driving pulley and the driven machine.

Flat belts require regular, but not frequent, attention to keep them safe, efficient and long wearing. Balata cotton belts should have castor oil rubbed into the outside face once a year, to keep them flexible. Rubber cotton belts, however, must not be oiled. Resin should not be used to prevent belt slip ; it rots cotton and cracks leather. Belt fasteners should be kept in trim condition so that there are no projections to jar on the pulleys.

An occasional overhaul of each machine is needed to maintain high efficiency : for example, the output of a grinding mill drops seriously when the parts become worn. Apart from such rare overhauls and adjustments, the only regular attention required by components of the plant is cleaning and lubrication. The grates, flues and ducts of the drier must be kept clean, and the conveyors checked over from time to time.

Where the moving parts of the drying plant are electrically operated, it is most important to see that the motors are kept as dry, as cool, and as free from dust as possible. Heating can be caused by overloading and by inadequate ventilation. Overload switches to protect the motors should be fitted. If an electric motor has been installed too near the furnace and cannot easily be transferred to a cooler part of the building, an asbestos shield should be erected to keep it as cool as possible.

. . . and Field The field equipment needs much more frequent and detailed attention if reliability and efficiency are to be maintained throughout the season. For an example of how machinery in bad condition may affect field operations we can refer to some tests carried out by the research department of an American university, which showed that a mower with dull knife sections and ledger plates consumed one-third more power for its operation than did a machine in which the sections and ledger plates were newly sharpened to the correct angles and contours. With tractor operation, the additional power required is of little direct account, but the grass is torn off instead of being cut cleanly, and the resistance is bound to hasten the wear of the moving parts of the machine.

Loose, worn or damaged sections or ledger plates should be tightened or replaced. Sections should be discarded when they have been sharpened so many times that the triangle has come to a sharp point, for they cannot then engage the full length of the cutting edges of the finger plates.

In the elevator mechanisms of the various kinds of loader, transmission chains of one sort or another are often the main part, and these chains must be well looked after if the whole machine is to remain satisfactory. Their tension should be kept right but it should be remembered that excessive tightening of a badly stretched chain to stop it riding off the sprockets is bad practice ; often it will still ride off and in so doing will pull the sprockets towards each other with a strain that may damage the sprocket teeth or bend one of the shafts.

Chains that can be kept fairly free from grit should be oiled frequently ; occasionally they should be taken off, washed in paraffin and then soaked in oil. But where the chain, whatever its kind, has to run in dusty conditions, it is better to leave it dry, because oil attracts and holds grit.

Transport makes up a large part of the cost of producing dried grass, and it bears much of the responsibility for maintaining the even flow of

material to the drier. Tyres on trailers must be given careful attention. If the farm is fortunate enough to have standardized trailers with standardized wheel fittings, the provision of one spare wheel to serve several trailers is worth while. A spare for each trailer is expensive and is not often provided, but good tyre care can do much to prevent loss of working time.

Servicing Systems In considering the actual organization of machinery maintenance, both at the plant and in the field, we have to face the difficulty that the use of grass harvesting equipment is too seasonal and irregular for a simple all-the-year-round task method to be applied. Nevertheless, a daily and weekly routine throughout the drying season itself can do much to prevent breakdowns and excessive wear.

The mower furnishes a good example, whether it is a separate machine or is part of a cutter-collector: it is an implement that can advantageously be serviced by a modified time method, though not by a true task method. For instance, some types of pitman bearings wear rapidly if they are not lubricated every two hours. Other oil-holes or cups should be attended to twice daily during use. Bearings with pressure lubrication fittings should be greased once a day, and the grease should be forced into the bearings until clean grease comes out at the bearing housing. At a few places on the mower lubrication is only an annual job; enclosed gear cases should be drained, flushed with paraffin and refilled once each season.

A true task method of servicing can be applied to the tractors which are being used for mowing and collecting, and for towing trailers. The maintenance of the farm lorry can also be done in this way by adapting the makers' instructions. In most handbooks the maintenance intervals are set out in mileages: for example, it is recommended that at every 1,000 miles the oil should be drained out of the engine sump and replaced. But when we are using the lorry for, say, collecting grass in the field, the engine and some other parts of the vehicle will have done as much work during the slow moving, starting and stopping when the mileage indicator shows 100 miles as it would if it had been used on the road for 1,000 miles. Here, certainly, a time interval should be used: 60 hours' use is about right, so let us fix the time as once a fortnight during the season, with inspection of the dipstick each working day to see whether topping up is needed. At the same time the oil in the gear box, back axle, and steering box should be topped up. Attention to other maintenance jobs on the lorry can also be carried out on a time basis.

At the plant a task system with time intervals should certainly be followed for jobs such as replenishing the oil in plummer blocks on shafting, and for cleaning burners and ducts.

NEW GRASSLAND RESEARCH STATION

A NEW Grassland Research Station for Great Britain under the administration of an independent Governing Body is being established by the Minister of Agriculture and the Secretary of State for Scotland in co-operation with the Agricultural Research Council. It will cover 500 acres at Hurley, Berkshire, adjoining the new Berkshire Farm Institute, and will deal with problems relating to the sward, particularly the production and maintenance in areas of medium and low rainfall. The existing Grassland Improvement Station at Drayton, Stratford-on-Avon (at present attached to the Ministry of Agriculture), will be transferred to the new Governing Body and its staff will form a nucleus for the joint enterprise.

The work at Hurley, which will be under the scientific supervision of the Agricultural Research Council, will be carried out in close co-operation with that of the Welsh Plant Breeding Station, Aberystwyth, the Scottish Society for Research in Plant Breeding, and other Research Institutions. Grant aid will be given by the Ministry of Agriculture. The Governing Body of 13 scientists and farmers is to be constituted as a limited company, without share capital.

LINSEED TRIAL—1948

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THE difficulties of growing and harvesting linseed were brought home last season to many growers whose only experience of handling the crop had been gained in the ideal conditions of 1947. An account of a linseed trial at the Norfolk Agricultural Station, Sprowston, last year may, therefore, be of interest. The trial was designed to compare drilling in mid-March, mid-April, and mid-May; at each of these times three seed rates were used—25, 40, and 75 lb. per acre—and to complete the comparison each rate of seeding was sown in 4-inch and 8-inch rows. The whole area received 3 cwt. per acre of National Compound No. 2, applied in each instance on the seedbed immediately before drilling. For the April drilling the seedbed as prepared for March was used, since the weather was very dry at the time and further working might have dissipated such moisture as remained in the surface soil. A fresh seedbed was prepared for the May drilling. The variety used was Royal.

Insects and Pests In late April flea beetles were observed on both the March and April drilled areas, and a good control was obtained by dusting with 40 lb. per acre 5 per cent DDT dust. Attacks were also noted in early June on the late-drilled crop, and here again dusting checked the pest sufficiently to prevent serious damage.

By the end of May the linseed drilled in March and April had become very foul with annual weeds, especially poppy, charlock, and shepherd's purse, and the April drilling was dusted with 2 lb. per acre MCPA selective weedkiller in order to save the crop; it was realized that such action would unfairly penalize the earlier drilling, which could not be treated in the same way because the linseed was too forward to allow chemical weed-killers to be used with safety. A comparison with untreated strips showed that the dusting had checked the growth of weeds, especially poppy and shepherd's purse, and the linseed held its own for the rest of the season. During May and June favourable growing weather gave the May-drilled linseed an excellent start, and by July it looked very well and exceptionally clean compared with the earlier drillings. At this time the poppies were in full flower on the March drilling and it was evident that they were most abundant in the low and medium seed rates, although the difference between the medium and high seeding was not marked; there was, however, no apparent difference in weediness between the wide and narrow row-widths. In early August the May-drilled crop became slightly laid on those plots drilled at the high rate, but the crops sown at the low and medium seed rates were not affected. The amount of lodging was not influenced by row-width.

Harvesting The March drilling was directly harvested by combine harvester on August 30. To test the efficiency of the threshing a preliminary strip was harvested and the straw put through the drum a second time, but the amount of additional grain obtained in this way was negligible, and when the plots themselves were harvested the straw was not put through twice. The crop was dead ripe and quite dry, and no real difficulty was experienced either in cutting or threshing the crop. The moisture content of the grain was 9.3 per cent.

On September 24 the April drilling was cut by power binder, with the sheaf-tying mechanism disconnected. The considerable second growth of

foliage and a proportion of green bolls made direct combining impossible. On September 27, after three warm, dry days, the swath was combined by using the pick-up attachment. The grain and straw were not so dry in this case and it was necessary to regulate the passage of the swath into the drum by hand, particularly as the crop tended to wind itself round the pick-up attachment. Threshing was less efficient and it was necessary to put the straw through the drum a second time. The moisture content of the grain was 12.5 per cent.

By this time it had become evident that the May drilling would never ripen as a standing crop, and on September 29 it was cut very green by power binder. It would have been preferable to cut high, leaving a long stubble to keep the swath clear of the ground and facilitate drying, but it was found that unless the crop was cut close to the ground there was insufficient length of straw in the swath for it to pass readily up the canvases: when the straw was short the swath clogged between the platform and elevator canvas just behind the cutter-bar. Apart from this, the chief difficulty (attributable no doubt to the unripeness of the crop) was the tendency for the swath to build up on the divider, then to pass under and stop the platform canvas.

After some delay due to bad weather, the last-sown linseed was combined on October 22 by using the pick-up attachment. The difficulties experienced with the previous picking-up operation were encountered again and aggravated by the higher moisture content of the bolls and, to a less extent, the straw. Nevertheless, harvesting was carried through with comparatively few stoppages, but of necessity very slowly; any attempt to speed up the operation soon caused trouble. The remarkable capacity of linseed to dry out in the swath must be mentioned: four days before picking-up, the crop was so sodden that, having regard to the time of year, hope of being able to harvest it had almost been abandoned. As before, the straw was put through the drum a second time. The moisture content of the grain was 16.1 per cent.

The plot weights of grain were corrected for moisture content to that of the March drilling, with the following results:

Treatment		Yield of Grain *cwt. per acre*
Seed Rates	25 lb. per acre	9.60
	40 " " "	10.50
	75 " " "	10.57
	Significant difference	0.85
Time of Drilling	March 12	9.92
	April 12	10.40
	May 13	10.34
	No significant difference	
Spacing	8-inch rows	10.03
	4-inch rows	10.42
	No significant difference	

Some Observations on the Trial It would clearly be unwise to attach great importance to the results of a single year's work in a season when abnormal weather was experienced. Nevertheless, observation of the trial under the various experimental conditions which were being compared provided some useful information on the handling and cultivation of the crop.

It became apparent that when deciding the best time to drill one must take into account the trouble likely to be caused by annual weeds. If the linseed is sown early, annual weeds grow unchecked with the crop and may seriously compete with it; selective weedkillers may be used on linseed if

certain precautions are taken, but this remedy materially increases the cost of growing the crop. When sowing is delayed the linseed has a much better chance to grow away from the weeds, provided full advantage is taken of the opportunities for weed destruction before final preparation of the seed-bed. In most seasons, however, May drilling means that the seed must germinate in soil which is drying out, and linseed in its early stages is very susceptible to lack of moisture; moreover, the risk of flea beetle attack increases as the season advances; and the delay in ripening and the post-ponement of harvest add to the difficulties of handling the crop—difficulties which, even under the most favourable conditions, are not negligible. With good growing weather in May and June there is no reason why the late-sown crop should not succeed as it did last year, although the prospect of com-bining in the last week of October is not one that appeals to farmers. Perhaps on average a crop sown in April is most likely to succeed: such a compromise avoids the difficulties caused by late drilling and at the same time allows some cultivations against weeds before drilling.

Narrow rows are commonly advocated for two reasons: because a better cover of the ground is obtained and weed competition discouraged, and because at harvest wear and tear of the binder is reduced by more even distribution of the load along the length of the cutter-bar. In this trial the narrow rows appeared to be as weedy as the wide ones, and there was practically no difference in the yield of grain. The stems of the plants in the wide rows were much thicker, but this was no apparent disadvantage as far as ease of cutting was concerned.

Although a seed rate of only 25 lb. per acre resulted in a lower yield and increased weediness, the loss was not as great as might have been expected, and it is noteworthy that 40 lb. per acre gave as good results as 75 lb. Besides the appreciable saving in cost, there are grounds for believing that in barley a light seeding helps to lessen the risk of lodging, and it may be that the same is true of linseed: the fact that lodging of the late-sown linseed was confined to the plots drilled at the highest rate lends support to this view.

THE STORY OF BEE DISEASES INSURANCE

C. P. Abbott

OVER fifty years ago the British Beekeepers' Association tried to promote an Act of Parliament to assist in the battle against bee diseases, but public opinion was not then ready for such legislation. In those days were many ways of treating disease—most of them wrong—but it was recognized that Foul Brood was being spread from infected colonies. Few beekeepers could diagnose the disease, and when it had been diagnosed many of them refused to have the bees treated or destroyed. The absence of compensation was thought to be one of the reasons for this, and so in 1936 B.D.I. was formed as a Friendly Society to tackle the problem.

Its methods followed the Swiss scheme—members of Beekeepers' Associations affiliated to it agreed to have their colonies treated or destroyed, while B.D.I. found the experts to carry out the treatment or paid compensation for the loss of bees or equipment. About 5,000 members were enrolled, each paying an annual premium of 1d. per colony (6d. minimum). And so the great adventure began, with the general idea that the money collected in premiums should be shared among those who suffered loss, and that rates should be adjusted annually as experience was gained. Although only thirteen years ago, there was no way of estimating the amount of Foul Brood in the country, nor of assessing the amount of compensation for a given premium.

In the Society's first year, premiums totalled £144 and claims £135—an encouraging beginning.

Then in 1942 came the Foul Brood Disease of Bees Order. More and more disease was discovered, the claims on B.D.I. doubled in the first year, and steadily increased until in 1944 they totalled £1,500. B.D.I. had accepted the terms of the Order that all diseased colonies must be destroyed and had raised its minimum premium to 1s., so as to be able to pay rates of compensation more closely related to the cost of replacing bees. The maximum premium was 10s., which gave cover up to £30. At the end of 1944 B.D.I. had a deficit of about £300, although both membership and premiums had risen. This sum was, however, well covered by the share capital, and must be regarded as a trivial loss compared with the achievements of the Society. A loan from the Ministry of Agriculture provided a breathing space, and by the end of 1947 the Society, with nearly 20,000 members and £1,500 in hand, was well established. Last year claims totalled £3,000, of which £2,800 was insurable, but only £2,000 was paid since some members had not availed themselves of full cover.

Steps have now been taken to ensure that every member receives full details of the scheme. The rates of compensation for 1949 are as follows:

Annual Premium	1s.	1s. 6d.	2s.	3s.	4s.	Each additional 1s. over 4s.
Standard Cover	£2	£3	£4 10s.	£8	£12	£3
Cover with Health Bonus	£2 10s.	£4	£7	£12	£20	£5

The health bonus is payable only to those associations whose claims for the previous three years were less than the premiums paid in the same period. The maximum premium is still 10s.

Destroyed bees are paid for at 12s. 6d. per lb. in the spring, falling to 6s. 3d. at the end of the season, and combs at about the ruling prices. Thus a member with a single colony (which may be worth £7 10s. on B.D.I.'s valuation) can cover the risk of Foul Brood for less than 3s. Where several colonies are owned, experience shows that adequate cover can be provided by insuring for about £5 per colony.

B.D.I. is run by unpaid volunteers; it has handled over £10,000 in claims and its accounts are subject to public audit; it has cost its members only about 4 per cent for management; but above all, beginning as a great experiment, it has shown that it can cope with all the insurance against Foul Brood that is necessary; its funds remain—they belong to the members for their protection.

And what of the future? Premiums will rise or fall to meet the needs of the times, and the Society's activities will ultimately extend to cover other bee diseases.

AGRICULTURE IN CANADA

1. A GENERAL DESCRIPTION

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This is the first of two articles on agriculture in Canada. The second article will appear in next month's issue and will deal mainly with agricultural research.

CANADA now consists of the ten provinces of British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland.* The Federal or Dominion Government in Ottawa is responsible for national and international affairs, e.g., inter-provincial and overseas trade, post office, defence, etc., while each province has its own legislature and government which is responsible for domestic affairs, e.g., education, roads, labour, etc. Both the Dominion and Provincial governments have Departments of Agriculture.

The Farmers and Their Farms It is over 4,000 miles from the Atlantic to the Pacific coasts, i.e., five times as far as from Land's End to John O' Groats. Canada covers about 3,700,000 square miles (39 times the U.K. area), of which less than 300,000 square miles (180,000,000 acres) is being used for farming. Estimates as to how much the farming area could be extended vary from 25 to 100 million acres. The remainder of the country consists of forests, mountains, lakes and, in the far north, the barren tundra. About two-thirds of the farm land is in the three prairie provinces (Alberta, Saskatchewan, and Manitoba). Taking Canada as a whole (leaving out the Yukon and North-West Territories), there are about 4½ persons per square mile, compared with over 500 in the United Kingdom and about 750 in England and Wales. Although less than 10 per cent of the country is inhabited, the area of land being farmed per person (of the total population) is about sixteen times as great as in the United Kingdom.

Over 20 per cent of the population is engaged in farming, compared with only 7 per cent in the United Kingdom. The average size of farm in Canada is about 240 acres, of which about 125 acres are cultivated, i.e., under crops, fallow, and rotation hay and pasture. The remainder is largely woodland or rough grazing. However, there is a large degree of variation; for example, the average size of farms in Prince Edward Island and Nova Scotia is only about 100 acres, compared with about 450 acres in Saskatchewan and Alberta. Again, the average cultivated acreage (including rotation hay and pasture) per farm is under 30 acres in Nova Scotia, while in Saskatchewan it is about 260 acres. The average acreage per person gainfully employed in agriculture varies from about 40 in the maritime provinces to over 300 in the prairies.

Canadian farmers are well organized, through the Canadian Federation of Agriculture. The Federation, which is the only national farm organization, represents some 400,000 farmers, or about 55 per cent of all farmers in Canada. It is not a direct membership organization but a federation of the main agricultural organizations in Canada, including (a) commodity groups, such as milk producers, already organized on a national basis, (b) regional and provincial farmers' groups resembling our own Farmers' Union County Branches, and (c) producer co-operatives. The prestige of the Federation is steadily mounting. It is constructive in approach and its status is fully recognized by the Dominion Government.

* Last year Newfoundland voted in favour of joining Canada and is expected to become a province officially on March 31, 1949.

The Federation—reflecting Canadian dependence on overseas and foreign markets—is international in outlook and favours international commodity agreements, whilst domestically it stands for a stabilized farm economy.

About three-quarters of Canadian farmers own their farms; the remaining farms are about equally divided between tenants and part-owners. A large proportion are family farms worked without hired labour, there being an average of only about two hired farm workers to every five farms in Canada. In the wheat-growing areas of the prairies, where a two-year rotation of summer fallow and wheat or a three-year rotation of summer fallow, wheat and wheat is followed, one man can handle a 600-1,200-acre farm, using a high-powered tractor, heavy cultivating implements and a combine harvester. Mechanization has been increasing rapidly, although the intensity of farm tractors (four to every ten farmers) in Canada is not as high as in the United Kingdom, where it is over five to every ten farmers. Despite this, however, and the larger size of the farms, less labour is required per farm in Canada because the farming is not as intensive as in the United Kingdom.

Soils and Climate The country is divided into three well-defined areas by two great natural barriers. On the one hand, the Rocky Mountains cut off British Columbia from the three prairie provinces, while the Precambrian Shield (a vast area or rocks, lakes and forest and the source of much of Canada's mineral wealth and pulpwood), jutting down from the north on the eastern side of the prairies, separates the prairies from Ontario and the eastern provinces.

Apart from the tundra in the extreme north, the soils of Canada may be divided into two main regions. First, there are the podsols or podsolic soils of eastern Canada, the northern parts of the prairies and along the Pacific coast, which were formed under forest in humid or sub-humid conditions. They are generally deficient in phosphate and, in the maritime provinces and eastern Quebec, in lime also. These soils constitute less than half of Canada's farm land. The second main soil region contains more than half of the farmland and consists of the southern and central parts of the three prairie provinces, i.e., the main wheat-growing area. The soils there were formed under a grass type of vegetation in semi-arid to sub-humid conditions. They are well supplied with lime and range from slightly acid (pH 6.0) to moderately alkaline (pH 8.0). They are fertile soils and very productive when sufficient moisture is available. There is, of course, much variation within these main regions, which are further divided into ten or twelve different zones, the zones in turn being divided into many different soil types.

Generally speaking, the greatest extremes of heat and cold occur in the prairies. The winters become rather milder going from the prairies eastward to the maritime provinces, and considerably milder going westward to the Pacific coast. While some of the highest summer day temperatures are recorded in the prairies, the summer nights there are relatively cool, so that in practice the highest average summer temperatures are in southern Ontario. This is one reason why southern Ontario is such an excellent fruit area and why such good progress has been made there in the growing of tobacco, maize and soya beans. Going northward in all provinces the winters get more severe, the summers cooler, and the growing season shorter. Growth is more rapid in most areas of Canada than in the United Kingdom, but nevertheless in the prairies and northerly areas the short growing season (only 75 to 120 frost-free days) is a limiting factor to production and would

be even more so were it not for the great progress that Canadian plant breeders have made in breeding earlier maturing crop varieties.

With the exception of south-western Ontario, Vancouver Island, the coastal area of British Columbia and a part of southern Alberta where Chinook winds (warm winds from the Pacific) periodically melt the snow, the entire country is frostbound and snow-covered for four or more months of the year. More elaborate housing is, therefore, needed for livestock (including sheep) than in the United Kingdom.

Average annual precipitation (including snow—calculated as rain) is about forty inches in the maritime Provinces and, going westward, gradually falls to about thirty inches in parts of Ontario, twenty inches in southern Manitoba and as low as ten inches in parts of southern Saskatchewan and Alberta. (In the latter areas evaporation is particularly high, thus accentuating the effects of the low precipitation.) Towards the foothills of the Rocky Mountains the precipitation becomes heavier again, rising to nearly twenty inches. This relatively high rainfall area extends a long way eastward from the Rockies in the north central region of Alberta and has resulted in a large area of mixed farming in north central Alberta and, to a less extent, in north central Saskatchewan (Calgary, Edmonton, Prince Albert triangle). In more northerly areas such as the Peace River country of Alberta and British Columbia, annual precipitation falls again to fifteen inches or less. Precipitation is also very low in many of the farmed valleys of the Rockies, e.g., the Okanagan Valley, where most of British Columbia's famous apples are grown, has an annual precipitation of only about ten inches and is dependent on irrigation. On the other hand, in the Fraser Valley of British Columbia and along the Pacific coast the annual precipitation (mostly rain) rises to over sixty inches, and in general the climate there is fairly similar to that in the United Kingdom.

Types of Farming As might be expected in such a large country with a wide variety of climatic conditions, there is great variation between the types of farming in different areas. In brief, the farming in eastern Canada is similar in many respects to farming in the United Kingdom, while farming in the prairies is mostly very different.

EASTERN CANADA In most areas of eastern Canada the farming is mixed, and milk, bacon and egg production are important features. Dairying is, of course, more intensive in the regions convenient to the main cities, e.g., southern Quebec (supplying Quebec City and Montreal), the Ottawa Valley and the area around Toronto, than in the more outlying areas. Eastern farmers buy and feed large quantities of feed grains (mostly oats and barley) grown in the prairies. This practice increased greatly during the war when Canada expanded her production of livestock products and reduced exports of cereals to meet war needs.

Some areas specialize in certain crops, e.g., the Annapolis Valley of Nova Scotia in apples, Prince Edward Island and north-western New Brunswick in seed and ware potatoes, the Niagara Peninsula of Ontario in fruits and vegetables, and south-western Ontario in tobacco, soya beans and maize for grain. In Newfoundland there is relatively little commercial farming; milk and vegetables are the two most important products.

THE PRAIRIES Although wheat is the main crop of the prairies, the farming there varies from the almost pure wheat growing of the south-central prairies (where, because of drought, any other crop is too risky) to the mixed crop and livestock farming of the northern areas, where soil moisture is not such a limiting factor. Also in the prairie provinces

there are (a) the rolling, dry areas of south-western Saskatchewan and south-eastern Alberta, and the foothills of the Rocky Mountains in Alberta, where only cattle (and occasionally sheep) ranching is carried on, and (b) about three-quarters of a million acres of irrigated land, mostly in southern Alberta, where the farming is intensive and includes the fattening of cattle and the growing of special crops such as sugar beet, peas, and other canning crops.

Summing up by provinces, the situation in the prairies is that mixed farming predominates in Manitoba, while grain growing predominates in Saskatchewan. Even in Saskatchewan, however, there is a gradation from the almost pure wheat growing and pure cattle ranching in the south to the mixed crops and livestock production in the north. Alberta has a greater proportion of mixed farming and more variety than Saskatchewan. Its farming includes pure ranching in the west and south-east, pure wheat growing in the east, irrigated farming in the south, and milk, bacon and beef production in the north.

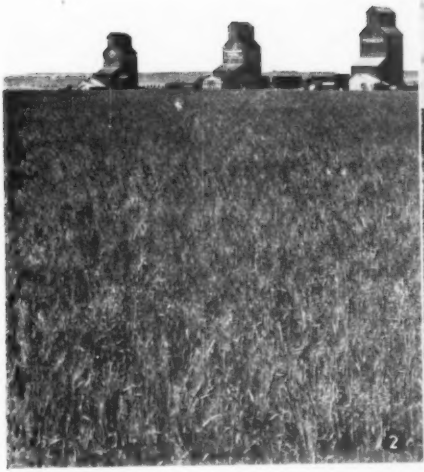
BRITISH COLUMBIA This province has been described as a "Sea of Mountains," but there is a wide variety of farming carried on in some mountain valleys and in the coastal belt. The Okanagan and other valleys running north-south in the southern part of the Canadian Rockies concentrate on fruit and vegetable production, e.g., the bulk of British Columbia's apples are grown in the Okanagan Valley and the Kootenay Lakes district. One of the most intensive dairying areas in Canada is the Fraser Valley which runs east-west and touches the coast near Vancouver; there the climate is somewhat similar to that in the United Kingdom. In the more northerly valleys of British Columbia cattle ranching, with small scattered areas of dairying and mixed farming to supply mining towns, is the rule. On Vancouver Island and, to some extent, in parts of the Fraser Valley market gardening and the growing of special crops, such as flowers and vegetables for seed, predominate.

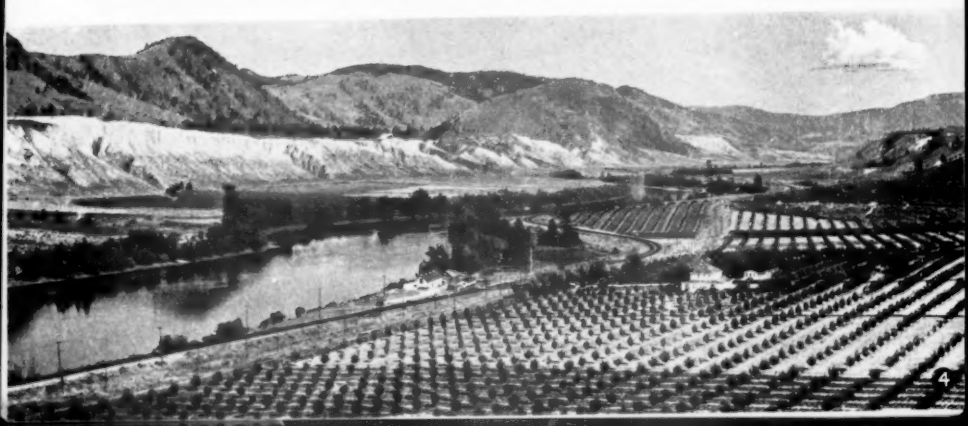
Intensity of Farming Generally speaking, farming in the eastern provinces and in the valleys of British Columbia is more intensive than that in the prairies—crop yields are higher and the proportion of livestock greater, e.g., the three prairie provinces, although having two-thirds of Canada's farm land, have less than half of each class of livestock. Again, with the exception of a few relatively small areas such as the Niagara Peninsula and certain other parts of south-western Ontario and the Fraser Valley of British Columbia, the farming, even in eastern Canada, is not as intensive as that in the United Kingdom. Nearly half of the land in farms in both eastern and western Canada is officially described as "unimproved" (i.e., rough grazing). This land contributes only a small amount of grazing for a few months in the summer, but much of it would not be economical to cultivate. The trend is for farmers slowly to bring more of the better areas of this land into cultivation and to make greater use of rotation pastures, but it will probably be many years before the pressure of population will be great enough to make it economical for Canadian farmers to use their land as intensively as do United Kingdom farmers; in many large areas it would be impossible without irrigation.

Typical Canadian Farming

1. Rounding up cattle on the range along the Milk River, S. Alberta.
2. Prairie wheat field near Stewart Valley, Saskatchewan.
3. Cultivating potatoes near Salmonhurst, New Brunswick.
4. New planting of apple trees in S. Thompson Valley, B. Columbia.

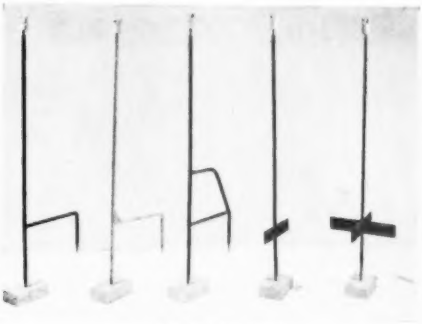
Photos. 1, 2 and 4: *National Film Board of Canada.*
Photo. 3: *Dominion Department of Agriculture, Ottawa*



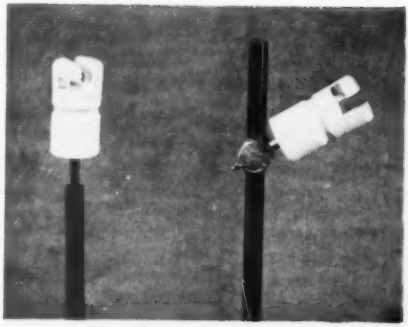


1. Crowding is caused by reducing the length of fold wire below 2 yards per cow.

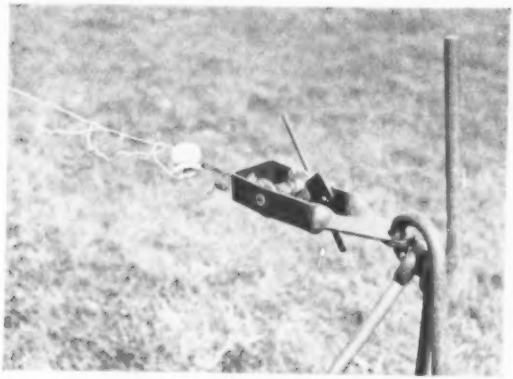
2. There is no crowding and little damage to the crop if 3 yards' run per cow is allowed.



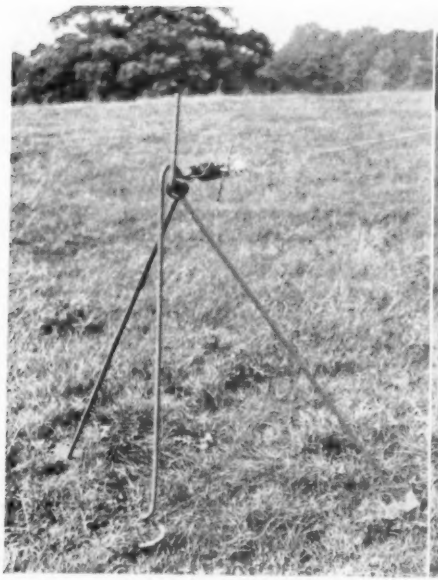
3. Metal rod posts.

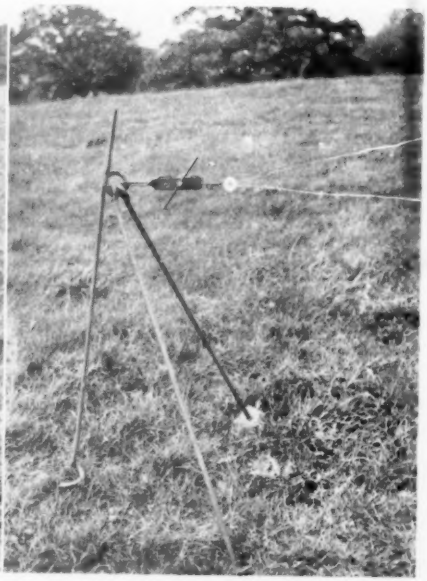


4. Shed-type insulators.



5. Wire-straining device.





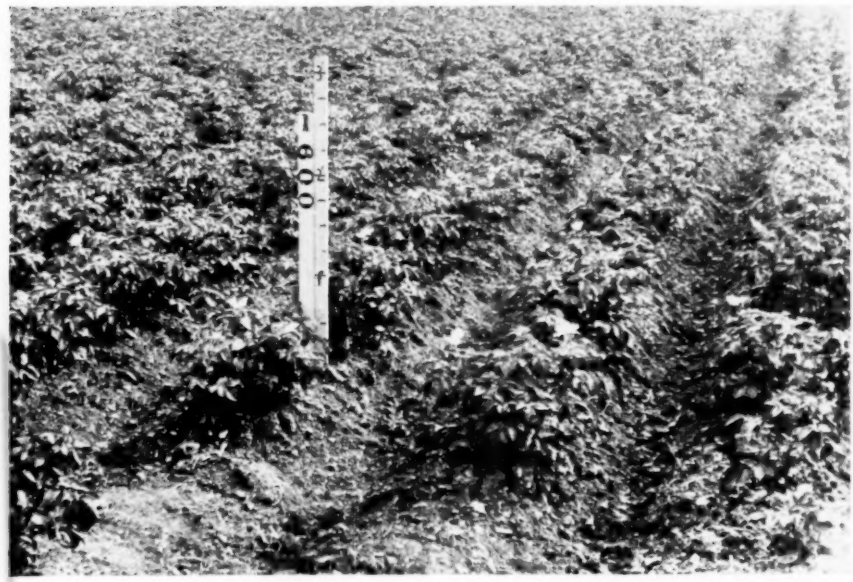
Photos: *N.I.R.D., Reading*

6. Wire-straining device mounted on tripod anchor with corkscrew rear leg.

7. Straining anchor used instead of a corner post in a fixed position.

MANURING THE POTATO CROP ON WOLD LAND

(See pp. 32-4)



Plot receiving 6 cwt. per acre sulphate of ammonia only.

Plot receiving 6 cwt. sulphate of ammonia, 8 cwt. superphosphate, and 6 cwt. muriate of potash per acre.

Both photographs were taken on July 24th, 1947. Marker indicates the height in feet of the haulm.

It has been estimated that the water supply will limit irrigation to three or four million acres (a small proportion of the total) and it may not be economical to reach this limit for many years, depending on the rate of increase of population, world markets, etc.

Table 1 shows 1937 and 1942 average yields for the prairies, Ontario and Canada as a whole of five important crops which are common to both the United Kingdom and Canada. These two years have no particular significance for Ontario, but in the prairies 1937 was one of the worst years ever experienced, while 1942 was one of the best.

Table 1

Average Yields per Acre of Selected Crops in the Prairie Provinces in 1937 and 1942, compared with those of Ontario and Canada as a whole

Crop	Unit	Year	Alberta	Saskatchewan	Manitoba	Ontario	Canada
Wheat	bus.	1937	9.7	2.6	15.7	25.0	7.0
		1942	26.8	24.7	27.5	30.4	25.8
		Average 1908–40	18.0	15.0	16.0	24.0	16.0
Oats	bus.	1937	27.6	5.1	30.5	32.6	20.6
		1942	53.3	52.0	47.3	43.0	47.3
		Average 1908–40	34.0	29.0	30.0	35.0	31.0
Barley	bus.	1937	22.2	4.7	25.0	28.8	19.2
		1942	39.0	37.3	36.6	34.5	37.2
		Average 1908–40	25.0	22.0	23.0	30.0	24.0
Potatoes*	short tons	1937	4.5	1.4	4.0	3.4	4.0
		1942	4.8	4.5	4.1	3.0	4.3
		Average 1908–40	4.2	3.7	3.9	3.4	4.3
Hay and Clover*	short tons	1937	1.23	0.53	1.92	1.69	1.50
		1942	1.70	1.94	1.90	1.92	1.65
		Average 1908–40	1.4	1.5	1.6	1.5	1.5

Source: Dominion Bureau of Statistics.

* The average yield of potatoes in the maritime provinces is much higher than in Ontario or the prairies. The average in short tons per acre over the period 1908–40 was 5.7 in New Brunswick, 5.2 in Nova Scotia, and 5.3 in Prince Edward Island.

Both potatoes and "hay and clover" occupy only small acreages in the prairies and tend to be grown in the more favourable areas, while in eastern Canada they are widespread. This explains the relatively high yields of these crops in the prairies compared with Ontario.

Table 1 illustrates:

(a) the great variation that may occur in yields from year to year, especially in the prairies (because of the great variation in annual rainfall—the limiting factor);

(b) the lower average yields of cereals in the prairies compared with Ontario (mainly because of drought), except in the best years on the prairies;

(c) the lower average yields of Canada as a whole compared with the United Kingdom. The ten-year average (1937-46) in the United Kingdom was 34 bushels of wheat and barley, 44 bushels of oats, and 8.0 short tons of potatoes per acre.

Canadian farmers get lower yields than United Kingdom farmers, partly because of a less favourable growing climate and partly because there is not

the same economic necessity to get high yields as there is in the United Kingdom, e.g., Canadian farmers use less artificial fertilizers and less labour than United Kingdom farmers. By and large, farmers tend to make most use of the factors of production that are plentiful and relatively cheap. So far it has cost less in Canada to achieve volume by increasing the quantity of land than by increasing the quantity of labour used. This contributes to lower yields per acre in Canada than in the United Kingdom.

Again, mainly because of the relatively small population of Canada (under 13 millions, or one quarter of the United Kingdom population), Canadian farmers produce a lower proportion of the perishable, higher-priced products such as liquid milk, fresh vegetables, etc., than do United Kingdom farmers, and a greater proportion of grain. Largely because of this and the lower crop yields in Canada, the total value of all Canadian farm production is less than that of all United Kingdom farm production. In other words, the value of Canadian agricultural production per acre of land in farms is about one-quarter of that in the United Kingdom.

Breeds of Livestock Canadian pedigree livestock are of a high standard, but, as in the United Kingdom, the majority of farmers keep non-pedigree stock. One of the most noticeable things about the cattle is that the Dairy Shorthorn is hardly to be found in any of the dairying areas. The few Dairy Shorthorns that are kept in some other areas are much closer to the Scotch Shorthorn than are English Dairy Shorthorns.

The most popular dairy breed is the Holstein Friesian, with the Ayrshire, Guernsey and Jersey next in importance. Canadian Holsteins tend to be slightly leaner and less dual-purpose than are British Friesians. The main beef breeds are the Hereford, Shorthorn, and Aberdeen Angus. The Hereford is by far the most popular on the ranches in western Canada, no other breed having such a good combination of quality, hardiness and ability to forage on the range.

Practically all the pigs in Canada are Yorkshires (Large Whites) of a type suitable for the production of Wiltshire sides for the United Kingdom market. The present high standard is largely a result of the Advanced Registry Scheme (litter testing) and carcass grading introduced about twenty years ago, at a time when Canadian bacon was unable to compete with Danish in the United Kingdom. Sheep do not occupy a very important place in Canadian farming, the total sheep population now being only about one-eighth of that in the United Kingdom. In eastern Canada the most popular breeds are Suffolk, Hampshire, and South Down ; on the range of western Canada the Rambouillet is preferred because they are better foragers and, having a flocking instinct, are more easily kept together in large flocks.

Price Stabilization Policy The Dominion Government has a definite policy of stabilizing prices of farm products. So far this policy has been implemented in two ways : (a) through long-term food contracts with the United Kingdom, and (b) through an Agricultural Prices Support Board set up in 1944.

The *long-term contracts* have covered wheat, bacon, eggs, cheese and other products. The wheat contract, for instance, provided that Canada would supply the United Kingdom with 160,000,000 bushels (4,500,000 tons) of wheat in the years 1946-47 and 1947-48, and 140,000,000 bushels in the years 1948-49 and 1949-50. When the agreement was made in 1946 the price during the first two years was fixed at $1.55 per bushel (basis Fort William), while a *minimum* price of $1.00 per bushel was guaranteed for the last two years, with the proviso that the *actual* prices for these two years should be negotiated before the end of December preceding each of the two

years in question and would have regard to the difference between the world prices and the contract price of the first two years.

In the case of livestock and other products, the quantities and prices have, generally, been subject to review each year. Because of shortage of dollars, the United Kingdom has already stopped buying poultry and apples and has had to reduce 1949 egg purchases. The Dominion Government has, therefore, been looking out for alternative outlets for surpluses of these products.

The Agricultural Prices Support Board consists of two farmers' representatives and a Chairman who is an officer of the Dominion Department of Agriculture. The Board has been charged with the responsibility of seeing that farmers get economic returns and fair prices. It operates on the basis of keeping the general level of agricultural returns reasonable and does not guarantee (or announce long in advance) minimum prices to every individual farmer or on every individual product. The Board believes that stabilization of returns for the major products has a beneficial effect on all products.

The Board keeps a continuous eye on the general farm price position, with the object of taking action to meet any situation that may arise. For instance, if the price of a product is falling unduly, the Board may establish a "support" price for that product and "honour" that minimum price by (a) a system of deficiency of equalization payments, rather on the lines of our pre-war wheat deficiency payments, and (b) purchasing the product through normal trade channels and reselling later in any manner it thinks fit. Both these methods have been used for potatoes and for Nova Scotia apples which were in surplus supply as a result of the United Kingdom's having to discontinue purchases because of dollar shortage.

Production Policy and Trends Official policy is to increase diversification of Canadian farming, mainly by bringing about an increase in mixed farming and livestock production in suitable parts of the prairies and by so making conditions that as large a proportion as possible of the surplus feed grain in the prairies will be converted into livestock products by eastern Canadian farmers.

The reasons for this policy are : (a) the need for more balanced farming to stabilize income and conserve soil resources, particularly in the prairies ; (b) a desire to hold the United Kingdom bacon and egg markets against competition from United Kingdom and European farmers ; and (c) a desire to increase overall financial returns to Canadian farmers. Livestock production, especially pigs and poultry, increased rapidly during the war when the United Kingdom had to cut down production of bacon and eggs and import more of these from Canada (to save shipping space), and when grains were not in large demand outside Canada. These trends are evident from Table 2, which gives figures for the numbers of livestock and acres of crops in Canada in the pre-war, war-time and post-war periods.

Since the end of the war livestock production has declined, mainly because of the lack of interest of prairie farmers in livestock while (as at present) they can make enough money more easily by selling grain and, to a less extent, because of a lack of confidence on the part of farmers in the continuation of the large war-time demand in the United Kingdom for Canadian livestock products.

Canada has large surpluses of wheat, bacon, beef, eggs, cheese and apples for export and in the future may also have substantial quantities of feed grains (oats and barley). The greater proportion of these surpluses, except beef and eggs, has always been sold in the United Kingdom market and during the last war the proportion of Canadian food exports to the United

Kingdom increased still further (including large increases in beef and eggs). Although still higher than in 1938, these exports have declined since the end of the war, largely because the United Kingdom has found it necessary to reduce dollar expenditure; e.g., poultry, meat and apple exports to the United Kingdom have ceased and eggs and bacon are going on a reduced scale. Table 3 compares United Kingdom imports of the main items of food and tobacco from Canada and from all sources in the years 1936, 1946, and 1948. It would be difficult to forecast the level of future exports of Canadian agricultural products to the United Kingdom. From a United Kingdom point of view, shortage of dollars is the limiting factor, and it would seem that the level of imports from Canada in the future will depend largely on economic progress in the United Kingdom and the sale of more industrial products in Canada.

TABLE 2

Acreage of principal Crops* and numbers of Livestock† in Canada, 1935-48
(thousands)

Commodity	1935–39 (average)	1943–45 (average)	1947	1948
Grain and Forage Crops				
Wheat	25,595	21,183	24,260	24,106
Oats	13,247	14,705	11,049	11,201
Barley	4,291	7,679	7,465	6,495
Mixed grain	1,165	1,478	1,150	1,542
Rye	816	570	1,156	2,103
Husking corn (maize)	172	246	176	252
Summer fallow (prairie provinces)	15,682	20,093	19,440	19,409
Hay and clover	8,766	10,052	10,202	9,748
Alfalfa hay	854	1,551	1,135	1,317
Oilseed Crops				
Soya beans	10	39	61	94
Rape seed		12	58	80
Sunflower seed		19	25	28
Flax seed	307	1,777	1,571	1,935
Other Crops				
Potatoes	516	525	497	508
Dried beans	68	94	97	92
Dried peas	85	93	128	82
Sugar beet	52	56	59	59
Fibre flax	8	32	11	14
Tobacco	70	84	126	110
Livestock				
Horses	2,833	2,698	2,032	1,905
Cattle	8,716	10,257	9,718	9,470
Pigs	3,939	7,305	5,473	4,463
Sheep and lambs	3,082	3,602	2,707	2,251
Poultry	53,317	75,854	88,264	72,581

Sources: *For crops*— Averages for 1935–39 and 1943–45—commodity reports prepared for the Dominion-Provincial Agricultural Outlook Conference, December, 1947.
Figures for 1947 and 1948—Dominion Bureau of Statistics.

For livestock—Dominion Bureau of Statistics.

* Omitting fruits and vegetables—seed crops.

† At June 1.

Table 3

Imports of Selected Items of Food and Tobacco into the United Kingdom from Canada and from all sources combined

1938, 1946 AND 1948

(millions)

Commodity	Unit	1938		1946		1948	
		Canada	All Sources	Canada	All Sources	Canada	All Sources
Total Grain and Flour	cwt.*	44.38	200.15	68.89	87.00	79.37	152.40
Wheat	,,	28.83	101.63	57.69	67.44	66.57	84.65
Barley	,,	5.47	19.88	‡	2.20	‡	15.62
Oats	,,	1.48	1.58	1.51	2.10	‡	5.88
Maize	,,	‡	57.58	‡	2.39	‡	26.64
Other Animal Feeding-stuffs†	,,	2.15	38.07	‡	2.31	‡	17.17
Total Meats, including Bacon	,,	1.61	30.96	3.99	27.14	2.44	22.55
Bacon	,,	1.28	6.87	2.58	3.50	1.87	2.67
Butter	,,	0.03	9.52	‡	4.23	‡	5.45
Cheese	,,	0.68	2.93	1.00	4.07	0.32	3.14
Eggs in Shell	doz.	1.50	276.98	38.48	81.33	45.89	154.52
Eggs, dried whole	cwt.*	‡	‡	0.11	0.91	0.09	0.12
Fresh Fruits and Vegetables	,,	3.08	42.32	1.29	16.68	‡	34.34
Tobacco	lb.	16.09	346.15	9.36	433.46	12.68	281.12

Source: Accounts Relating to Trade and Navigation of the United Kingdom, December, 1947, and December, 1948. (H.M.S.O., London).

† Mainly wheat offals and oilseed cakes and meals.

‡ Little or none.

The help of Dr. J. F. Booth, Mr. S. R. N. Hodgins, Dr. E. S. Hopkins and Dr. K. W. Neatby of the Dominion Department of Agriculture, Ottawa, who read a preliminary draft of this article and suggested many valuable amendments, is gratefully acknowledged.

MANURING THE POTATO CROP ON WOLD LAND

R. B. FERRO, N.D.A., *County Agricultural Officer, Yorks (East Riding)*
and H. TREFOR JONES, M.Sc., F.R.I.C., *Provincial Soil Chemist*

THE ravages of the potato root eelworm in the main potato growing districts and the importance of potato production at the present time have resulted in some of the acreage being moved into areas not accustomed to the crop. This has happened in the East Riding of Yorkshire, where at the present time an increasing acreage is being grown upon wold land. In some "new" localities the crop has become well established and, where altitude and other circumstances are suitable, "S.S.," "A" and "H" certified seed is being produced. Whether the crop is for seed or ware production, manuring is of great importance in obtaining a satisfactory yield.

The Yorkshire wolds cover some 200,000 acres in the East Riding, running from Flamborough in the north, westerly almost to Malton, and then in a southerly direction almost to the River Humber. The soils on the high wolds to the north, derived from the underlying chalk, are thin and contain flints. Since they lie at an altitude of 300–750 feet above sea level and are very exposed, the season is about two to three weeks later than on the adjoining lowlands. Normal ploughing depth is 4 to 6 inches but, with heavier deep-digging ploughs, it is often possible to plough 9 to 10 inches deep and obtain a useful tilth. Towards the southern end of the wolds, the soils are deeper and do not present such difficult problems.

Long before the war it was known that many of the high wold soils were deficient in potash and, more recently, soil surveys have shown that the potash deficiency is common to most of this area. Reserves of available phosphoric acid are usually satisfactory. Consequently, if potatoes are to be grown successfully, particular attention must be given to manuring and special allowance made for the shortage of potash.

Three-Year Trials on Committee Farm The trials which provide the material for this article were conducted during 1946, 1947 and 1948, at Bella Farm, Wharram, which the East Riding Agricultural Executive Committee have had in hand since 1941. Potatoes are now taken regularly in the rotation as part of the root-break. The soil is typical of the high wolds already described, and lies at an altitude of approximately 600 feet above sea level.

A basal dressing of nitrogen in the form of sulphate of ammonia at 6 cwt. per acre was applied to all the plots. Three levels of phosphatic manuring were employed: 0, 4 and 8 cwt. per acre of 18 per cent superphosphate. The potash was applied at three levels: 0, 3 and 6 cwt. per acre of 60 per cent muriate of potash. The treatments were applied singly and in all combinations, and accommodated in a randomized block lay-out.

Each year the potato crop followed wheat which had been grown after grazing seeds. The wheat stubble was ploughed about 10 inches deep in November or December and, whilst farmyard manure was applied to the adjoining field crop of potatoes, it was withheld from the plots to avoid complications with the dressings under investigation. Gladstone seed from Northern Ireland ("S.S." or "A" certificate) was planted on April 10, 1946, and May 8, 1947, the Scottish "S.S." Gladstone on April 26, 1948. The usual cultural operations were carried out.

Climatically, the three seasons have provided interesting contrasts. In 1946 a cold period followed planting, and later there was prolonged and abnormally heavy rainfall from the beginning of August until lifting time in mid-October. On the other hand, 1947, after the exceptional blizzards

which delayed planting until May 8, was abnormally dry, and it seemed that the yields that year might show a substantial reduction compared with those in 1946. It is apparent from the data in the Table that these fears proved groundless. The winter of 1947–48 was mild and open, and spring cultivations in 1948 were earlier than usual. Nevertheless, the weather was more variable after planting, and growth was backward throughout the summer. A cool, showery August and early September was followed by a bright, dry autumn, and the yields in 1948 were lower than those in the two preceding years.

Total Yields of Potatoes from Various Treatments, 1946-48

(The figures in parentheses show the yields compared with the control expressed as 100)

Treatment			Total Yield per Acre		
Sulphate of Ammonia	Super-phosphate	Muriate of Potash	1946	1947	1948
cwt. per acre	*cwt. per acre*	*cwt. per acre*	*tons*	*tons*	*tons*
6	0	0	3.53 (100)	4.43 (100)	2.39 (100)
6	4	0	4.51 (126)	3.51 (79)	1.85 (77)
6	8	0	3.42 (96)	3.46 (78)	1.55 (65)
6	0	3	9.32 (260)	9.13 (206)	5.90 (247)
6	4	3	10.07 (281)	10.17 (230)	7.76 (325)
6	8	3	10.70 (299)	9.20 (208)	8.05 (337)
6	0	6	9.72 (271)	8.78 (198)	6.66 (279)
6	4	6	11.45 (320)	11.49 (259)	7.99 (334)
6	8	6	12.25 (342)	11.60 (262)	8.48 (355)
Significant Difference			1.95 (55)	2.13 (48)	0.99 (41)

Potash and Higher Yields The striking feature of the results summarized in the Table is the highly significant effect of potash in increasing the yields, and it is further proof of the acute deficiency of potash in these soils. Even in the absence of dressings of superphosphate, the sulphate of ammonia and 3 cwt. per acre muriate of potash more than doubled the yield ; when superphosphate was added and the potash increased to 6 cwt. per acre, a further improvement was obtained up to about 11-12 tons per acre in 1946 and 1947, and 8½ tons in 1948. The effect of the phosphate is slight compared with that obtained from the potash and, indeed, the addition of superphosphate in the absence of muriate of potash has tended to depress the yield. On the other hand, higher yields were not obtained by increasing the potash from 3 to 6 cwt. per acre unless additional phosphate was also given, and these results emphasize the importance of balance in the manuring of the potato crop according to the conditions in which it is to be grown. The potash not

only increased the total weight of tubers but also significantly reduced the proportion of chats and thus increased the yield of saleable potatoes. At all levels the application of potash was economic, as was the total dressing of fertilizer.

Almost from the time the shoots emerged from the soil the characteristic discoloration of the leaves indicative of potash deficiency was clearly visible on the plots receiving no potash. During the late summer the haulm on these plots withered and suffered severely from a slight attack of Blight, which had little effect on the plots receiving the potash dressings. The illustrations (p. iv of art inset) show the differences in growth of foliage.

Samples of the potatoes from each plot were subject to cooking tests, and, whilst there was serious stem-end blackening on most of the samples after cooking (a common fault with many samples of purchased potatoes at the present time), it was particularly severe on those from the plots which received no potash. Furthermore the potatoes grown without potash were of an extremely unpleasant, glutinous consistency when steamed and mashed. The differences were less when the potatoes were fried than when they were steamed, but the samples grown without potash were still the worst.

The authors wish to thank the East Riding County Agricultural Executive Committee for providing the facilities, and their colleagues, Messrs. W. W. Gatenby, F. W. Hutchison, J. T. R. Lockwood W. N. Smith, J. Strachan and J. Webber, for their assistance in carrying out the trials. They are also indebted to Dr. L. H. Lampitt, Director and Chief Chemist, Messrs. J. Lyons and Co., Ltd., who very kindly conducted the cooking tests on the samples.

A SMALL TYPE OF HOME-MADE DUSTING MACHINE FOR RIDGE AND ROWCROP WORK

L. N. STANILAND, A.R.C.S., D.I.C. and J. MAYOR
National Agricultural Advisory Service, Bristol

DEMONSTRATIONS of the home-made rowcrop dusting machine already described in this JOURNAL* have shown that there is a demand for a small hand-drawn version, which would be especially valuable on intensive holdings and small farms. Such a model has now been designed and this article gives the necessary information for its construction; it should be read in conjunction with the previous article. The principles of construction are very similar, but this latest model is smaller, lighter and simpler; the cost is much lower—not more than £1 perhaps if scrap wood is available.

Framework The framework is roughly on the same plan, and the machine travels on the single "square wheel" (which in this case has a side of only 1 foot) and the rear ends of the side members, which act as skids. These ends are weighted with sufficient scrap lead or iron to make the machine stable, and at the front of the machine is some simple strutting to increase

* STANILAND, L. N. and MAYOR, J. A Home-made Dusting Machine for Ridge and Rowcrop Work. *Agriculture* (August, 1948), 203. Now available in leaflet form free from the Ministry, 1 St. Andrew's Place, Regent's Park, N.W.1.

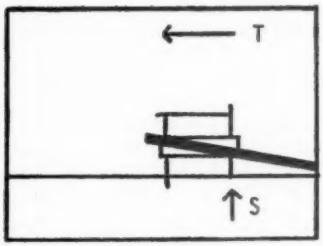


Fig. 1

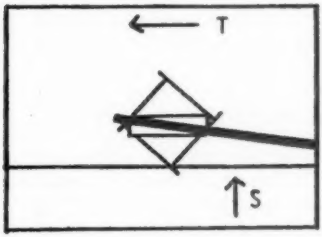


Fig. 2

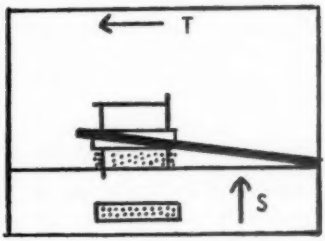


Fig. 3

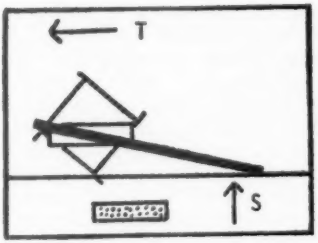


Fig. 4

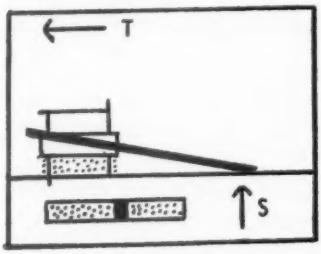


Fig. 5

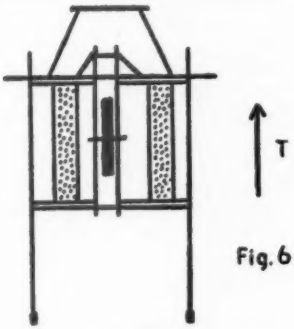


Fig. 6

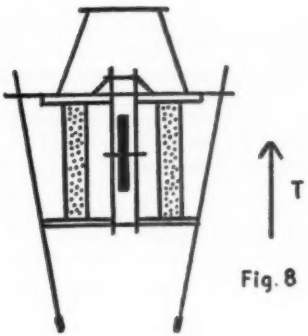


Fig. 8

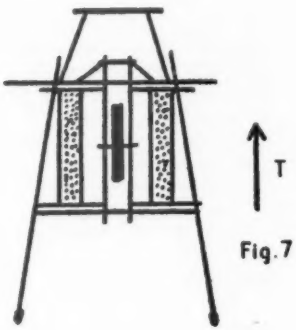


Fig. 7

PLATE I

rigidity. The important dimensions are shown in the plan in Plate 1, Fig. 1. The machine, as illustrated, is designed for rows 30 inches apart, but a new feature is embodied so that adjustments may quickly be made to cover a range of row widths. The two bolts marked "A" are provided with wing nuts, and those marked "B" with ordinary nuts. A series of holes drilled in the front cross member and in the front portion of the side members make it possible to turn the rear ends of the side members from the parallel position (Plate 2, Fig. 6) outwards, as shown in Fig. 7, or inwards (Fig. 8). Before drilling the holes, the best positions should be found by trial and by measuring the distance between the rear ends of the side members. The weights on the ends of the rear members should be sufficiently great to ensure rigidity in the position shown in Fig. 8.

Dust Hoppers The hessian dust hoppers are attached to side boards as before; the measurements for this model are given in Plate 1, Fig. 4, and the hoppers are made up as previously described. Hessian wind-shields are attached to the side boards, and are made in pocket form to hold a few stones so as to keep them just touching the ground. The dust hopper and screens are shown in section in Plate 1, Fig. 5.

The dust hoppers are adjustable for position as regards row width and width of dust band to be laid; but they are not adjustable for height above ground. A suitable height is about four inches from the bottom of the hopper to the ground, but the grower can decide for himself what is likely to be the best height for his purpose.

Two boards "C" and "D", most easily seen in the side view in Plate 1, Fig. 2, are attached to the inside faces of the front and rear cross members, as shown in Fig. 3. The front board is attached by screws to the bevelled rear edge of the front cross member. The front edge of the rear cross member is bevelled the other way, and the board is attached by means of metal angles, "E", which are supplied bent to more than 90 degrees. By this means the dust hoppers will lie exactly horizontal when they are dropped nto position. The boards are provided with a number of vertical fillets of wood ("F" in Figs. 1 and 3) to provide many positions for the hoppers. A strip of wood ("G") runs below each row of fillets to prevent the hopper side boards dropping through. Light wooden lids should be attached to the hopper side boards by strings, to prevent dust from blowing about.

The Machine in Operation It has now been found that two ropes running from the machine to a wooden bar (see Plate 2, Figs. 6, 7 and 8, where arrow "T" indicates direction of travel) give the best control for steering. A single hitch is not so good either with this machine or with the larger model previously described.

The principle of the working of the machine is shown in diagrammatic form in Plate 2, Figs. 1–5 (arrow "T" shows direction of travel; arrow "S" indicates the starting position). The operations shown may briefly be described as follows:

Fig. 1. Machine at start on wheel side No. 1.

Fig. 2. Machine starts and rears up on point of square wheel.

Fig. 3. Machine turns on to wheel side No. 2 and dust is jarred from the hoppers to form a band on each row of plants, the band being a little longer than the side of the wheel.

Fig. 4. Machine continues and rears up on the next point of the square wheel.

Fig. 5. Machine now turns on to side No. 3, and another pair of dust bands is laid. These slightly overlap the first and the result is a pair of continuous lines of dust; and so the work continues.

A SMALL TYPE OF HOME-MADE DUSTING MACHINE

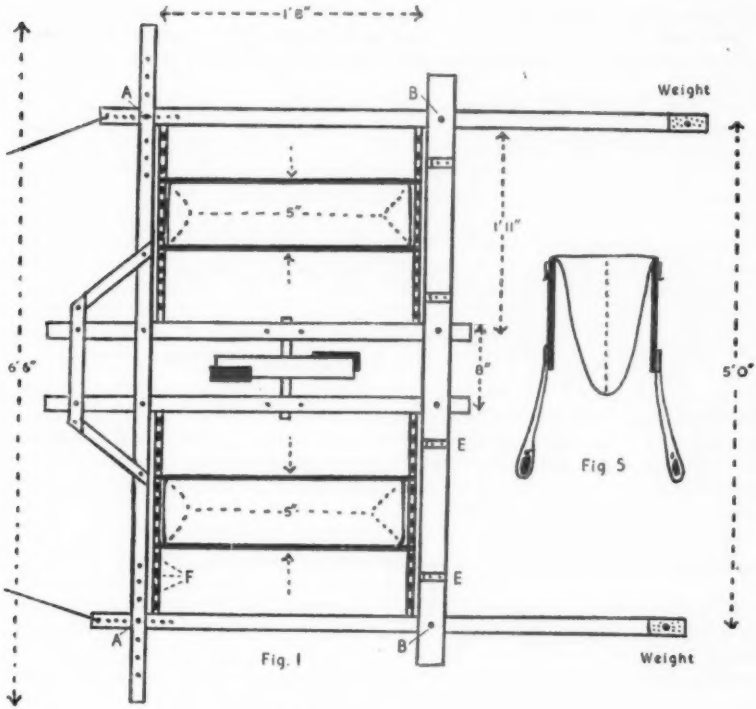


Fig. 1

Fig. 5

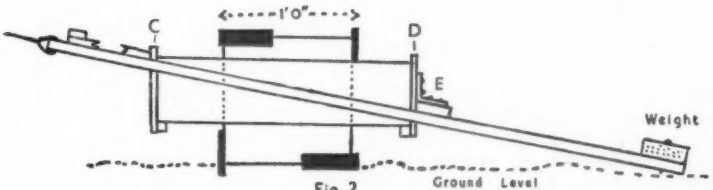


Fig. 2

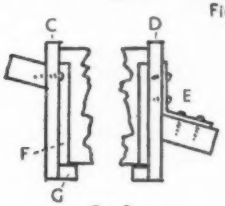


Fig. 3

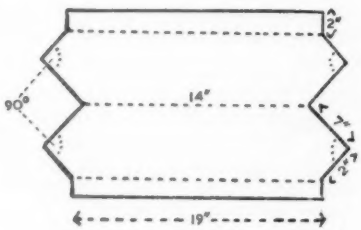


Fig. 4

PLATE 2

A SMALL TYPE OF HOME-MADE DUSTING MACHINE

Adjustment of the density of dusting by the use of various grades of hessian, and varying the speed of travel to suit hardness of ground, etc., are as described before. Turning at headlands is simply a matter of lifting the front with the tow-bar and swinging round into the next rows.

FARM BUILDINGS CONFERENCE

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THE Farm Buildings Conference held in Norwich at the end of last year was something of an occasion. It was the first of its kind and brought together about three hundred of the leading people connected with agriculture in Norfolk, as well as some from beyond. Subsequent interest has been considerable and lasting.

Taxation and Finance Economics and finance play such a large part in the provision and improvement, as well as in the maintenance, of farm buildings, that first place in the programme was given to a paper on Taxation and Finance, a subject which Major Nelson Rooke covered clearly and fully. He gave a masterly summary of the financial implications of recent legislation. Major Rooke's opinion was that the rules of good estate management, according to Section 10 of the Agriculture Act, 1947, as well as those of good husbandry (Section 11), can reasonably be fulfilled by landlords and tenants if they take advantage of concessions given under the Income Tax and Finance Acts.

Under Section 35 of the Agriculture Act, 1947, a landlord may charge an increased rent to cover improvements. He may be entitled, thanks to the Income Tax Act, 1945, to an allowance equal to one-tenth of capital expenditure on agricultural buildings in each of the following ten years. Examples of such expenditure are—construction, reconstruction, alteration or improvement of farm buildings, cottages, fences or other works, including drainage, sewerage, walls, shelter belts, and the like. There is a limitation in the case of farmhouses of not more than one-third of the expenditure.

Farmers and landowners were reminded of the grants payable out of State funds of 50 per cent of the agreed cost of approved schemes for land drainage and rural water supplies, as well as those under the Hill Farming Act, 1946, where some twenty-three improvements are listed. Section 42 of the Agriculture Act, 1947, enables repairs to fixed equipment to be paid for out of Trust funds, without repayment out of income—an important point for those concerned with the administration of Trustees' Estates, and a considerable advance beyond the Settled Land Act, 1925, which specified improvements which an owner who is a tenant for life might require to be financed by Trust funds. The importance of the maintenance claim was not overlooked, "as it plays a great part in enabling a landowner's obligations to be carried out". Major Rooke reminded his hearers that improvements,

such as the provision of cow byres under the Milk and Dairies Order, rank for maintenance relief, even if the work may be regarded as a capital improvement. Tenants may include the cost of repairs necessary under a tenancy agreement in their farm accounts and thus reduce tax liability under Schedule D. Failure by a tenant to keep his contract for the upkeep of equipment renders him liable for Dilapidations, under Section 57 of the Agricultural Holdings Act, 1948.

Major Rooke's conclusions were that there is a legal obligation to provide and maintain buildings and fixed equipment for the proper farming of the land. This brings reward to the nation as a whole as well as to individuals. In the main he felt that financial and Income Tax legislation enables these obligations to be fulfilled reasonably economically if advantage is taken of reliefs, concessions and grants available, not least of which is that under the Housing (Financial Misc. Provisions) Act, 1946, which provides for a subsidy of £15 per year per cottage to be obtained from a Local Authority where a cottage is to be provided for a farm worker.

Farmstead Planning for Economy Mr. Benoy dealt with an altogether different aspect of the subject. He advised that before any drastic step is taken to provide new buildings or repair old ones, full consideration should be given to "certain vital questions": "Are the buildings on the right site in relation to the land? Can they be drained? Is there adequate water, and what is the position as regards electric power, preferably three-phase?" The balance between these factors has to be struck. He confirmed the view of many who are concerned with repair and adaptation or providing new farm buildings—that before any major change is made a master plan of the homestead should be prepared. This plan should be fully discussed between the landlord, the tenant and the architect or surveyor. Advantage should be taken of the help of Farm Buildings Advisory Officers and other officers of the Agricultural Land Service. Buildings unfit for repair need only be measured and drawn in outline. The plan will show the relationship of one building to another—an important point where traffic circulations are being considered. It is these circulations which, if correctly planned, can achieve real economy of labour engaged in handling livestock, feedingstuffs, fertilizers and produce, particularly milk. Where major reconstruction is necessary it is often advisable to provide a new building rather than incur heavy expenditure on an old one which will require a substantial amount of maintenance. There may be a short-term economy by converting old buildings, but in the longer term outgoings are inevitably greater. It should not be overlooked, however, that first appearances are often deceptive, and small expenditure on joinery, glazing and paint may save from demolition buildings with many useful years before them.

Mr. Benoy's definition of a good cottage was most valuable: "There should be a kitchen-living-room, sitting-room, scullery, larder, wash-house, garden shed, three bedrooms and a bathroom; there should be hot and cold water and water sanitation; the premises should be dry and well-lit and free from vermin. And these standards are not as unobtainable in old cottages as might appear at first sight, though it is usually an expensive matter to cure rising damp."

Standard Farm Building Components Mr. P. J. Moss gave many interesting figures of the amount, in terms of money, being expended on new farm buildings and on jobs costing more than £100. Compared with £5,500,000 of work in 1946,

£7,500,000 were spent in 1947. In the first half of 1948 the estimated expenditure was the same as that for the whole of 1946.

He advocated the use of standard structural components, which have effected economies in steel because they are made of salvaged material. When this material comes to an end the principle of the M.A.F. scheme of standardization will remain. Like for like, buildings constructed with these components compare favourably in cost with buildings constructed from traditional materials, and there is not the difficulty about permits for controlled materials.

Looking ahead, Mr. Moss thought that there would continue to be dependence on such materials as bricks, concrete and steel, with some timber, but he foresaw important developments in the use particularly of timber and concrete. New methods of fastening structural timber members are being adopted ; lamination gives greater strength for less weight and has considerable possibilities for development on mass-production lines. Prestressed concrete also has big possibilities, especially if mass-produced. Mr. Moss felt assured that a measure of standardization in farm buildings makes for adaptability. High building costs may remain, but it should be possible for them to be borne "by good farmers growing good crops and keeping good stock". The need for farmers to estimate carefully the ratio between their yields and production and their investment in buildings was discussed.

More Co-operation The fourth paper at the Conference was given by Lord Portsmouth, who considered that good estate management and good husbandry should not be departmentalized. They are complementary, and if this is remembered it will be seen that there are abundant opportunities for more co-operation. Lord Portsmouth suggested that larger farmers or the larger estate should help smaller neighbours, for instance through the Estate Yard which it would be uneconomical for the small estate to maintain, or by book-keeping. There should be "Learn More Clubs" as well as "Grow More Clubs". There is room for co-operation when schemes for electricity and water are prepared and also in woodland matters. The larger estate could look after the small parcels of trees so frequently found on English farms.

Due consideration should be given to the home and working environment of farm workers. On present wage rates and with the present labour shortage there is no room for wasted effort, and farming is an arduous job in which it is desirable to reduce effort whenever possible. Sometimes this could be by adaptation and re-design of buildings. Premises should be kept clean and dry, and Lord Portsmouth felt that no unnecessary walking or lifting should be done by any worker. Here he touched upon the same point as Mr. Benoy, when he referred to farm circulations. There is, however, a danger that purely functional buildings may be uneconomical because they are not adaptable. Comfort for both man and beast is a paying proposition. A dry, light room where men can change their clothes or shelter during meal-times is an advantage on any farm.

The breadth of the subject covered by the four speakers was great. Other aspects of the same subject will occur to all who are interested in the occupation, ownership or management of rural property. It is to be hoped that they will be dealt with at other Conferences, which will doubtless be as interesting and stimulating as was that at Norwich.

FARMING AFFAIRS

Two New Hops resistant to Verticillium Wilt

Two new varieties of hops raised at Wye College, and known experimentally as OR 55 and OJ 47, have been pronounced by Dr. W. G. Keyworth of East Malling Research Station as being moderately resistant to the progressive form of Verticillium Wilt. Both appear to be strong growers—a "plant" of 7 feet by 7 feet has been found satisfactory, and indeed is recommended, since, with closer planting, the danger of attack by Downy Mildew is increased. The ordinary height of wirework is suitable for OJ 47 ; OR 55 is likely to benefit from a slightly higher wiring.

Both varieties are immune from the effects of Mosaic, although they can carry the virus. For this reason neither should be planted close to Goldings and " Goldings Varieties". Fuggle, which is likewise a carrier of Mosaic, would of course be unaffected.

Brewing trials made in 1945 and 1948 in various parts of England and in Scotland showed both varieties to be probably acceptable in blends of 10-30 per cent with other hops. Last year a committee appointed by the Hops Marketing Board arranged for the propagation of these varieties on a large scale in order that rooted sets should be available to growers on gardens where, because of the presence of the Verticillium fungus, Fuggle and other varieties have failed. Application for sets should be made to the Secretary, Medway House, High Street, Maidstone. It is proposed to give the name of " Keyworth's Midseason " to OR 55, and " Keyworth's Early " to OJ 47.

A detailed description of each of these new varieties, together with the trials data, is given by Professor E. S. Salmon in an illustrated brochure issued by Wye College, Kent, price 2s. 6d.

Oedema of the Bowel in Pigs

Oedema of the bowel in pigs is a condition which causes losses in different parts of the British Isles and Eire. It has been known for some time, but it seems to have been on the increase during the past few years. The disease occurs most commonly in pigs 8-12 weeks old, but it has been found in both younger and older animals All the pigs in a group do not necessarily become affected and it is usually the best thriving pigs that show evidence of the conditions.

Frequently no symptoms of illness are observed, the first sign of any trouble being the death of one or more pigs. In other cases there may be a swelling of the eyelids, and paralysis sometimes occurs. It is only on post-mortem examination that a diagnosis can be made: the oedematous condition of parts of the lining of the stomach and intestines is typical of the disease, but it has been noted that the oedema gradually disappears after death, so that if the examination is delayed more than twenty-four hours little evidence of actual oedema may be found. The cause of the disease is not known, and attempts to reproduce it have been unsuccessful ; it seems to be related in some way to food, but nothing definite can yet be stated.

Following the diagnosis of the disease in a group of pigs further cases may be prevented by adopting the following simple procedure. Remove all the food from the troughs and feed bran mashes to which Epsom salts have been added. During the three succeeding days continue to feed bran mashes but gradually reintroduce the original or new feedingstuff with less bran. In some herds in which the disease has often occurred the adoption of the practice of worming the young pigs at about 10 weeks old and the giving of doses of Epsom salts periodically has been followed by a freedom from further cases. Although there appears to be some relationship between food and the

occurrence of oedema of the bowel, there is no evidence that any particular foods or food mixtures are responsible. Further research work on this relationship and on the true cause of the disease is being undertaken.

Poultry-keeping Accounts A useful new account book* has been prepared to enable poultry owners to keep a record of receipts and payments and a profit and loss account over a period of twelve months. At the end there is a page of notes on income tax to assist the owner in the preparation of the year's balance sheet, a detachable copy of which is provided so that the details can be sent to the tax authorities in a convenient form with the minimum of trouble.

Nature Month by Month—April Everywhere, now, there is evidence of that marvellous yearly resurrection which men call spring. In the meadows there is bright, new, green grass, and flowers appear overnight as if by magic. Most of the trees are still bare of leaves, but in the orchards there is pear blossom in plenty. In the woods the birches, soon to have their first, soft, spring dress, are a symphony in grey, black and silver. In the marsh the tips of the osiers glow blood-red when the sun catches them, and here and there a willow tree already shows a film of green.

Daily the incoming host of migrants grows in volume. Soon the cuckoo will be here ; one listens for the "wandering voice" about the middle of the month. Wryneck, swallow, martin and a great company of warblers will swell the ranks of the friendly invasion. About mid-month the woods will ring again with the melody of nightingales ; already the willow-warbler's little lilting song has been heard by copse and wayside

The chaffinch sings lustily "on the orchard bough," and the blackbird—best, perhaps, of all our singers—is coming into full voice and vigour. A pair of tiny wrens, with much fuss and importance, are building their domed nest among the exposed roots of an overturned tree. What an amazing song is the wren's : it seems almost unbelievable that so much can come from so small a throat.

For most wild mammals the days of plenty have come again. Fox and badger, hare and rabbit, stoat and weasel, all find easier feeding and will do so increasingly with the waxing of spring. There are fox and badger cubs in the covert earths and setts, and many young rabbits in the bankside buries.

Female peacocks and small tortoiseshells are seeking nettles whereon to lay the eggs from which future generations of butterflies will stem. Also, less happily, we may see the first emergence of cabbage whites from the chrysalids that have lain dormant all winter. The awakened queen humble bees are looking now in earnest for new nesting quarters, and many queen wasps are about the same business.

April in England—how aptly Browning sang its praises. Bird song and blossom, white clouds drifting across a sky of purest blue, showers and sunshine and the myriad scents of the countryside ; all these things help to make an April which is unrivalled anywhere on earth.

F.H.L.

**The Superba Account Book and Record of Sales.* J. R. HARVEY, F.C.I.S. S.P.B.A. Supplies Ltd. 7s. 6d.

FUTURE AGRICULTURAL PRICES

IN accordance with the provisions of Part I of the Agriculture Act, 1947, the Agricultural Departments have reviewed the economic position of the agricultural industry in consultation with representatives of the producers' organizations and in the light of this review the Government has fixed the prices to be paid for those agricultural products for which markets are assured and prices guaranteed, i.e., for milk, fat cattle, fat sheep and lambs, fat pigs and eggs for the twelve months beginning April 1, 1949, and for wheat, barley, oats, rye, potatoes and sugar beet to be harvested in 1950.

In consequence of the awards of the Agricultural Wages Boards for England and Wales made on March 2, and for Northern Ireland made on March 15, and in accordance with the arrangements agreed between the Government and the National Farmers' Unions which were announced in the House of Commons on November 21, 1946 a special review has also been held and adjustments have been made to the prices of crops for harvesting in 1949, which were previously fixed following the review held in February, 1948.

In fixing the prices for livestock products for 1949–50 and for crops of the 1950 harvest, the Government has taken into account not only the economic position of the industry and changes in costs of production which have occurred or are imminent, but also the White Paper on Personal Incomes, Costs and Prices. Account has also been taken of the need to give special encouragement to certain products, notably wheat and fat pigs, of which an increase in production is most necessary in the national interest.

The alterations in prices which the Government has approved are as follows :

Crops to be harvested in 1949	Increase over average prices previously announced
Wheat	3d. per cwt.
Barley (maximum)	3d. ,, ,,
,, (minimum)	3d. ,, ,,
Oats	3d. ,, ,,
Rye	3d. ,, ,,
Potatoes	6s. 9d. per ton.
Sugar Beet	1s. 9d. ,, ,,

Crops to be harvested in 1950	Increase over 1949 average prices announced in August, 1947
Wheat	5s. 0d. per cwt. (acreage payments to be discontinued)
Barley—Malting. A maximum price for malting barley has not been fixed, but the position will be reviewed early in 1950 and a further announcement then made.	—
,, —Feeding. Guaranteed fixed price of 21s. 6d. per cwt.	—
Oats (maximum)	1s. 0d. per cwt.
,, (minimum)	9d. ,, ,,
Rye—The existing fixed price to be a minimum price and acreage payments to be retained.	—
Potatoes—The Government is considering the decontrol of early potatoes in 1950. A separate announcement will be made about this shortly.	10s. 0d. per ton (acreage payment to be £10 per acre on total acreage).
Sugar Beet	2s. 0d. per ton.

In future, the guaranteed price of barley, which has been fixed at 21s. 6d. per cwt. will relate to all barley, provided it is of satisfactory quality and in fair marketable condition. The standard of quality will be agreed shortly with the National Farmers' Unions. Any barley which can be treated at a maximum cost of 2s. per cwt. to render it suitable for purchase will also be covered by the guarantee.

The average price increases for potatoes of the 1949 and 1950 crops include and continue the addition of 3s. per ton which was made for the 1948 crop to offset the rise for that year in the cost of seed.

Livestock 1949–50	Average overall increase over 1948–49	Operative date
Milk	2½d. per gallon	April 1, 1949
Fat Cattle	4s. 6d. per live cwt.	March 21, 1949
Fat Sheep	½d. per lb.	March 21, 1949
Fat Pigs	6s. 9d. per score dead weight	April 4, 1949
Eggs	1d. per dozen	March 31, 1949

All the above prices are the average increases over the whole of the quantities sold, irrespective of any grade or seasonal variations where applicable. The increases will not be uniformly applied, and for a number of commodities there will be variations in seasonal or grade price increases. In particular it is proposed to introduce seasonal prices for eggs with a commencing price of 3s. 9d. per dozen as from March 31 next. This figure will be increased to a price of not less than 5s. per dozen for a winter period to be announced later, the price falling again to 3s. 9d. per dozen towards the close of year under review. On the basis of the two previous years' deliveries to packing stations, the figures agreed will give an average price of 4s. 1d. per dozen for the year. Other things being equal, but subject, of course, to the outcome of the next annual review in February, 1950, and to the guaranteed minimum price of 3s. 4d. per dozen, it is expected that the average price of eggs in the year 1950–51 will be reduced below the new figure of 4s. 1d. per dozen.

Wool Although wool is not one of the products for which prices are guaranteed under the Agriculture Act, 1947, the 1949 clip will, as in previous years, be taken over by the Government at prices fixed in advance. This opportunity is being taken to announce that the substantial sum of £300,000 is being injected into prices of wool to facilitate the introduction of a new price schedule more closely related to prevailing market values. The details of the new Schedule are being discussed with the producers' representatives and will be announced in the near future.

OFFICIALLY APPROVED INSECTICIDES AND FUNGICIDES

In 1943 an account was given in this JOURNAL* of a voluntary scheme started by the Ministry of Agriculture and the Department of Agriculture for Scotland whereby official approval could be given to proprietary brands of insecticides and fungicides marketed in Great Britain for the control of pests and diseases of crops. One of the main objects of the scheme was to provide growers with the names of proprietary materials which, if properly applied under suitable conditions, would be satisfactory for the purposes stated on the labels. Since that time the scheme has progressed steadily, and the stage has now been reached when insecticides and fungicides in most of the important groups can be submitted for approval. Approved products in these groups are on the market and can be recognized by the official mark on the container, as illustrated here. Names of products

* **50**, 331.

OFFICIALLY APPROVED INSECTICIDES AND FUNGICIDES

added to, or withdrawn from, the approved list have been published in this JOURNAL periodically, and the latest additions are given below. To help growers select materials for use, a comprehensive list of the approved products (some 260 in all) has been published in leaflet form.†

The following products have been approved since the date of the list published in the February, 1949, issue of *Agriculture* (p. 503).

Derris and Lonchocarpus Insecticides to be used as Dusts :		
Derasift Derris Dust	Pan Britannica Industries Ltd.	**G 279**
Derris and Lonchocarpus Insecticides to be used as Sprays :		
Kilsect Derris Spray	Pan Britannica Industries Ltd.	**H 280**
Copper Fungicides (exclusive of Seed Dressings) to be used as Dusts :		
Kuraspud	Pan Britannica Industries Ltd.	**J 287**
Copper Fungicides (exclusive of Seed Dressings) to be used as Sprays :		
Kuraspot	Pan Britannica Industries Ltd.	**K 292**
Nicotine Insecticides to be used as Dusts:		
Destromite 3%	Pan Britannica Industries Ltd.	**O 282**
Destromite 4%	Pan Britannica Industries Ltd.	
Stock Emulsion Petroleum Oil Winter Washes :		
Dussek Brand Petroleum Wash	Dussek Bros. & Co. Ltd.	**S 301**
Sulphur Fungicides to be used as Dusts :		
Boots Sulphur Dust	Boots Pure Drug Co. Ltd.	**AA 308**
DDT Insecticides to be used as Dusts :		
Day, Son & Hewitt's General Purpose Horticultural Dust	Day, Son & Hewitt Ltd.	**AD 310**
DDT Insecticides to be used as Sprays :		
Boots DDT Spray (Horticultural)	Boots Pure Drug Co. Ltd.	**AE 303**
Benzene Hexachloride Insecticides to be used as Dusts :		
Agrocide 3	Plant Protection Ltd.	**AK 289**
Day, Son & Hewitt's Flea Beetle Dust	Day, Son & Hewitt Ltd.	**AK 311**
PBI Flea Beetle Dust	Pan Britannica Industries Ltd.	**AK 296**
DNC-Petroleum Oil Winter Washes :		
Dussek Brand DNC Wash	Dussek Bros. & Co. Ltd.	**AZ 300**
Calomel :		
Calomel M. & B.	May & Baker Ltd.	**BA 306**
Calomel Dusts (4%) :		
PBI Calomel Dust	Pan Britannica Industries Ltd.	**BB 284**
Prepared Greasebands :		
Boltac Ready Prepared Greasebands	Pan Britannica Industries Ltd.	**BE 287**

Products A 58, B 59 and D 120 *have been withdrawn from the list by the manufacturers.*

Ministry of Agriculture and Fisheries, Plant Pathology Laboratory, Harpenden, Herts. March, 1949.

† "Proprietary Products for the Control of Plant Pests and Diseases". Obtainable free from the Ministry, 1 St. Andrew's Place, Regent's Park, London, N.W.1.

BOOK REVIEWS

Pigs—Hints for Beginners. J. W. REID. National Pig Breeders' Association. 2s. 6d.

This book is a new and revised edition of the first edition published in 1936. Written in a simple and attractive style, it should, as is intended, prove of value and guidance to the beginner and, in particular, to ex-service men who are contemplating pig-keeping. At the same time it will hold the interest of those already established in pig husbandry, for although the author does not claim that the book is a complete survey on the breeding, feeding and management of pigs, he deals with the principles based on a wide practical experience and scientific experiments. He is wise to point out that pig-keeping should not at present be undertaken as a sole enterprise but rather as part of a more general system of farming

On the subject of breeding, his advice is to start with a good foundation stock and then expand cautiously along sound and systematic methods. On management and feeding, the author rightly emphasizes that the pigman is the all-important factor for success and profit, and must possess that quality which for want of a better term can be called "pig-sense".

There is a most helpful and clearly expressed chapter dealing with capital, including a section on the working capital required for a herd of twenty sows.

W.T.P.

A Manual of Beekeeping E. B. WEDMORE. Arnold. 18s.

In Mr. Wedmore's comprehensive book we have the essence of beekeeping theory and practice condensed into a handy volume of some 1600 numbered paragraphs. These paragraphs are grouped into sections covering all aspects of the craft with the exception of a few specialized subjects, such as bee anatomy and microscopy, and the economics of beekeeping, which are very wisely regarded as beyond the scope of a work of this kind.

The first edition of this manual appeared in 1932, and the second edition of 1945 has now been followed by a corrected reprint All the valuable features of the original text, including the tabular information on frame sizes and capacities, the water content and average densities of honeys, etc., have been retained, together with the numerous explanatory diagrams and the helpful system of cross-references; the omission of some items of doubtful theoretical or practical value, following the modern trend towards simplicity of equipment and management, has allowed the inclusion of much new information collected and sifted by the author during the intervening decade. The rearrangement whereby swarm control and management for honey production are considered in a single section brings together a mass of related material in a manner which is not only more orderly than that adopted previously, but which also helps to stress the fact that hive manipulations are essentially a means to an end, and not merely an excuse for donning a bee-veil or lighting the smoker.

This is a book to which all serious beekeepers should have ready access; not as a source of entertaining reading-matter but as a reliable work of reference, to be consulted with deliberation when planning future operations, or to be drawn upon at short notice when the unexpected happens—as it so often does where bees are concerned.

P.S.M.

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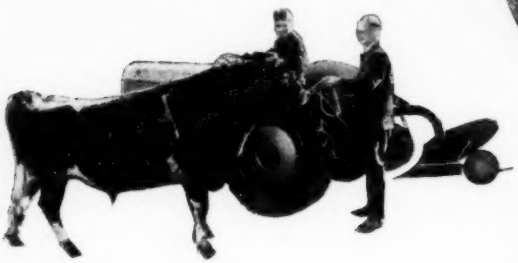
Floating FARMLAND



A Ferguson tractor turns a Somerset wilderness into land fit to support a pedigree herd of Guernseys

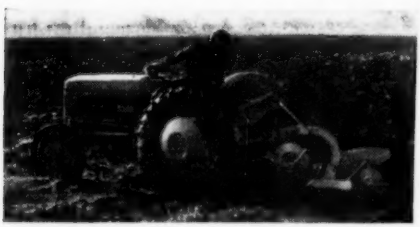
"The soil may be peat, but it floats on water," farmers warned Dr. William Plant when, two years ago, he bought Tickenham Court Farm, Clevedon, Somerset, and 110 acres of unpromising marginal land. Nevertheless, Dr. Plant announced his intention of establishing a pedigree herd of Guernseys and supporting them on this land that flooded for six to eight months every year.

Much of the land was deep peat soil on blue clay sub-soil, but without the usual acidity of peat thanks to the run-off from surrounding limestone ranges. It had the promise of richness, but could that richness be brought to light? Dr. Plant thought it could. He bought a Ferguson tractor (£325), a mower (£75), a 16" plough (£28) and an earth scoop (£12.10s.).

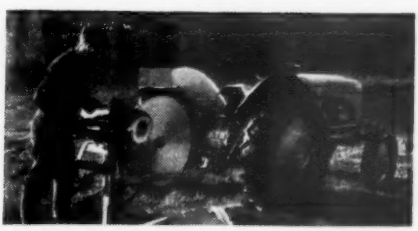
Bob Hawling uses the Ferguson earth scoop to shift soil from an irrigation ditch.

"The land simply was not negotiable except with a Ferguson," the Doctor tells us now. "And only a Ferguson with its mower could be used to cut the rushes successfully. They have to be cut three times a year and an ordinary trailer mower could not start early enough."

The rushes were cut, the rich soil was ploughed and arable crops were planted. Beans, linseed and oats thrived and rich, high-protein grass was provided for the yearlings which were imported from Guernsey as the nucleus of the herd in 1946. The first five heifers lactation was 840 gallons in 305 days and butterfat content of the milk was 4.7 per cent. The "floating farmland" had become a good deal more than self-supporting.



The deep-digger 16" Ferguson plough goes to work on land which two years ago farmers declared unworkable—until they saw it being worked by the Ferguson.



One Ferguson in its day plays many parts on Dr. Plant's farm. In the courtyard before the 14th century buildings of The Court, Bob Hawling gets to work with the wood saw.

FARM BETTER, FARM FASTER WITH FERGUSON

Ask your Ferguson Dealer for a demonstration on your farm.

FERGUSON SYSTEM

Ferguson Tractors are manufactured by the Standard Motor Co. Ltd., for Harry Ferguson Ltd., Coventry.

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